ELEC-
TRICITY
AND
LIGHT

Ekstrom

Helen Palmer.
Summerfield, Ohio.

Miss Helen Palmer.
Summerfield, Ohio.

FUNDAMENTALS

of

Electricity and Light

FOR THOSE ENGAGED IN

Beauty Culture Practice

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A TEXT BOOK OF THE ELEMENTARY PHYSICS AND PHYSIOLOGICAL EFFECTS OF ELECTRICAL MODALITIES AND LIGHT SOURCES USED IN THE PRACTICE OF BEAUTY CULTURE.

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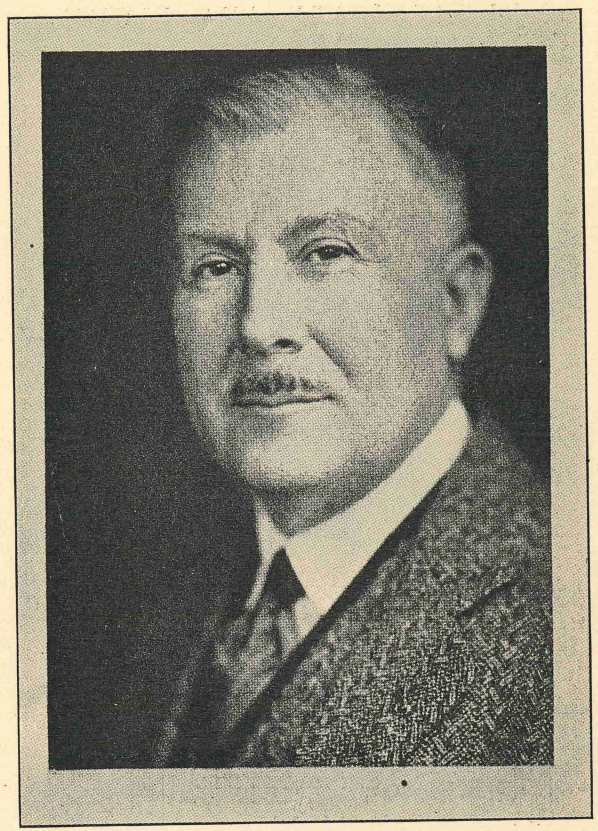

NOBLE M. EBERHART

INTRODUCTION

The adoption of my Physiotherapy Manual by the Illinois Board of Examiners for the Beauty Culture Profession reference text on the physics of Electricity and Light, brought to my attention the need of an authoritative work on this subject, couched in terms suitable for students of Beauty-Culture and kindred arts.

The books that have been in general use have been written by expert cosmetologists but not by those specializing in Electricity and Light, and therefore containing many errors as a result of trying to adapt or paraphrase the writings of others because of the lack of first-hand technical knowledge of electrophysics.

There is going on at the present time a definite and sincere effort to raise the educational standards and qualifications of those practicing the Cosmetic Arts. I have tried to aid in this movement. For more than twenty years I have lectured on Electrophysics to teachers and students of Beauty Culture, and to their organizations, and I feel as if I understood many of their problems.

I believe there should be a closer co-operation between the members of the Beauty Culture Profession and the Medical Profession.

For years electrolysis for the removal of superfluous hair, moles, etc., and the fulguration or desiccation of small growths has been performed by Beauty Culturists with at least the tacit consent of the Medical Profession. But electrodesiccation and electrofulguration and electrolysis are **electrosurgery** and come within the scope of the Medical Practice Acts of the

various states. I do not believe the Medical Profession will care to generally enter the field of electrolysis in superfluous hair, but in the removal of moles, warts and other small blemishes, it is important to know those which safely may be treated and those where there is grave danger, especially if not thoroughly destroyed, hence the necessity for medical supervision and co-operation.

It will be observed that individual manufacturer's apparatus is neither illustrated nor mentioned. My endeavor is to present, as the title indicates, The Fundamentals of Electrophysics and Light.

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Polarity.

NOTES

That quality of an electric current which indicates whether it is positive or negative as it enters or leaves the patron.

Test:
Attach cord to binding posts. Turn on current. Place tips in water. Bubbles will collect on negative pole. This is Hydrogen.

CHAPTER ONE

Modalities; Fundamentals; Electrical Units; Classification and General Action.

Modalities: The forms of electricity and light which will be considered in this text-book are—

1. The Galvanic Current
2. The Faradic Current
3. The Sinusoidal Current
4. The High Frequency Current
5. Radiant Light
6. Infra-Red
7. Ultraviolet

What is a Modality? The various measures are known as modalities. The term modality as herein used means any form of electricity or light and may be defined as a mode, or manner or method of employing either an electric current or a form of light. Thus the galvanic current is one modality; ultra-violet another, etc.

Learn the Fundamentals. Attention of the student is called to the importance of thoroughly mastering the elementary points and unavoidable technical terms so that the constant recurrence and use of these terms will cause no confusion. Once they are understood and made an intelligent part of one's vocabulary it becomes comparatively easy to understand the origin, nature and general action of the different measures; and with these facts clearly in mind their application is easily understood.

Remember that all of these modalities are **distinct and separate measures** and have a definite, individual and characteristic action, like so many different medicines or chemicals.

Physical Therapy also called physiotherapy covers the application to the body for treatment or cosmetic purposes of physical agents or measures as distinguished from drugs. The term has been restricted usually to those agents that are either electrical; or operated by; or dependent on electricity. Their advantage is in their direct application; absolute exactness of dosage; and definite, unchanging action. Non-electrical physical measures which would still be physical therapy are massage, exercise, baths, etc. Physiotherapy was the older term and physical therapy is preferred. In the text issued by the American Medical Association, it is defined as "The use of the physical, chemical and other properties

of heat, light, water, electricity, massage and exercise."

Present Concept of Matter. Formerly the most minute particle of matter was supposed to be the atom, but now we find that the atom is composed of still more minute particles, charged with electricity and known as ions. Those that carry a positive charge are called **protons** and those that carry a negative charge are **electrons.** Recently the positively charged ion has been called a **positron.** The atom consists of a central part or nucleus consisting of one or more protons with one or many electrons swinging around it, just as the earth and planets swing around the sun. Electrons have been measured, both as to size and speed. Each of our chemical elements, such as hydrogen, oxygen, carbon, etc., contains a definite number of protons and electrons. In short, it is the difference in the

number of electrons which constitutes the difference between the elements.

If hydrogen is taken as 1, helium represents 2, lithium 3, and so on. Uranium has the highest number, 92, and therefore the greatest number of electrons. At the present time there are 88 elements leaving four numbers in the scale between 1 and 92 for which no corresponding element has yet been discovered.

In a bubble of hydrogen gas there are billions of atoms and an electron is fully a thousand times smaller than the smallest atom. It has been said that if this bubble of hydrogen gas were magnified to the size of the earth, an atom in comparison would be the size of a tennis ball and an electron the size of a pinhead. All of this is to try and convey some thought of relative sizes, and is not to be taken as absolute fact.

Why Elements Combine With One Another. All chemical elements are either positive or negative and it is because of this fact and because positive and negative elements attract one another that they hold together in what we call a chemical combination or compound. If it were not for this fact we would have no chemical compounds. While opposite forms attract, like forms, as two positives, or two negatives tend to repel one another.

So we have positive hydrogen (H) combining with negative oxygen (O), in the form of two parts of one with one of the other to form H_2O or water. Or one part of sodium (Na) with one of chlorine (Cl) to give us Na Cl, sodium chloride or salt.

Some positive elements have a stronger attraction for negative elements than others and if opportunity offers, will displace the weaker element.

Electrical Units. In order to understand the use of electricity, certain units of measurement must be learned.

The **volt** is the unit of pressure or that which tends to move electricity from place to place. It may be likened to water pressure, and just as water always flows from a higher to a lower level and spreads out or equalizes its pressure, so voltage flows from a higher to a lower level through the connecting cords and the part of the body through which the current is travelling to produce an equal pressure or voltage throughout.

The cords or wires, electrodes, etc., through which the current flows form the **circuit.** For example, in the galvanic current the patron's circuit is from the positive pole along the cord to the patient and from the patient back through the other cord to the negative pole.

Voltage is created at the positive pole, so the current flows from positive to negative.

The obstruction to the free flow of the current offered by the wires in the cords and by the part of the body in the circuit is called **resistance,** and the unit of measurement of this resistance is called the **ohm.**

If pressure and resistance were equal we would have no current, but as voltage or pressure is produced in excess of resistance, a current flow is established.

The **ampere** is the **unit of current strength** or intensity; it is really the rate of flow. As an ampere is too much current for ordinary use, a unit for medical and beauty use has been established, known as a **milliampere,** and is 1/1000 of an ampere.

The **watt** is the unit of power—1 volt times 1 ampere equals 1 watt. An electrical horsepower is 746 watts.

The working power or effectiveness of any electrical apparatus depends on the number of watts it is capable of producing, and this in turn is due not merely to voltage, alone, nor to amperage, but to a product resulting from multiplying the voltage by the amperage.

Here is an easy way to remember volts, ohms and amperes.

Suppose we have a door with one man (Mr. Volt) trying to push it open, while another man (Mr. Ohm) is trying to hold it shut. Mr. Volt is stronger and forces the door open and a current of air (amperage) flows through.

General Action of Electricity and Light. There are three simple and easily understood effects which explain the reason for the use of our different measures.

1. They act to produce heat.
2. They have a chemical action or effect.

3. They act in a mechanical or exercise manner.

The radiant or white light possesses two properties: thermal (heat) and chemical. To understand this one must remember that when a beam of white light is passed through a three-cornered piece of crystal or glass, called a prism, it is split up into seven colors, known as the **spectrum.** These colors, beginning with the one having the longest waves and slowest rate of vibration, are red, orange, yellow, green, blue, indigo and violet. Red, orange and yellow produce heat while blue, indigo and violet possess chemical properties. We will take this up more in detail when we come to the article on Light.

Now let us come back to our classification:

Chemical—The galvanic current. The blue, indigo and violet contained in light. The invisible ultraviolet rays.

Mechanical (Exercise)—The faradic current. The sinusoidal current.

Thermal (Heat)—The red, orange and yellow contained in light. Invisible infra red. The high frequency currents.

NOTES

A fuse is a contrivance placed in the path of the electrical current as a safeguard.

A watt is a unit of electrical power.

Bi-polar - Galvanic
Uni-terminal -
Bi-terminal - Faradic

CHAPTER TWO

The Galvanic Current

The Galvanic Current is the only one of the currents we consider which has a genuine chemical action. It is the only one having **definite polarity.** It is this polarity which gives it its chemical power. It has a **positive** and a **negative** terminal or pole, each being the direct opposite of the other, just as much so, as day and night. Whatever one pole does the other does **exactly the opposite.** The plus sign + is used to designate the positive pole and the minus sign — for the negative.

As all chemical elements are either positive or negative, and as opposites attract one another, it will be seen that when the poles

of the galvanic current are placed in a solution, all of the negative elements will be drawn to or toward the positive pole and all of the positive elements to the negative pole. This splits up the solution and therefore accomplishes chemical analysis or separation by electricity.

Let me repeat this in order to thoroughly fix it in the mind of the student.

The poles of the galvanic current attract to themselves chemical elements of opposite polarity. That is, positive elements like hydrogen and like copper, zinc, and other metals, will be attracted to the negative pole of the galvanic current, while negative oxygen, iodine, etc., will be attracted to the positive pole. Not only do the poles attract to one another elements of opposite polarity but they also tend to repel or throw off elements of the same polarity. That is why we always make the

statement, when referring to polar action, that **opposites attract** and **likes repel.**

Determination of Polarity. Let us see now what happens if we put the ends of the cords which are attached to the positive and negative galvanic terminals (poles) in water and turn on some current (see Fig. 1). Water is composed of two parts of hydrogen and one part of oxygen, H_2O.

The positive hydrogen, being aggressive as all positives are (people included), has taken possession of the negative oxygen and is holding it to the limit of its strength, but no positive element is as powerfully positive as the actual positive pole of the current; so the latter pulls the oxygen away from the hydrogen and draws it toward itself. The hydrogen is in turn attracted by the strong influence of the negative pole and tends to travel to and gather

at that pole. In this manner, by the effect of polar attraction the water is gradually separated into its two component gases, hydrogen and oxygen, which are observed in the form of bubbles arising at the respective poles.

The action of the current on water has been used as a means of determining polarity, because the number of bubbles from the hydrogen will be greater than those from the oxygen since there is twice as much hydrogen present as there is oxygen.

As these hydrogen bubbles gather at the negative pole, we know that the terminal showing the greater number of bubbles must be the negative.

The wall-plate or other form of apparatus used, usually has the poles marked, but it is always a good idea to check up occasionally particularly when the wall-plate is on the

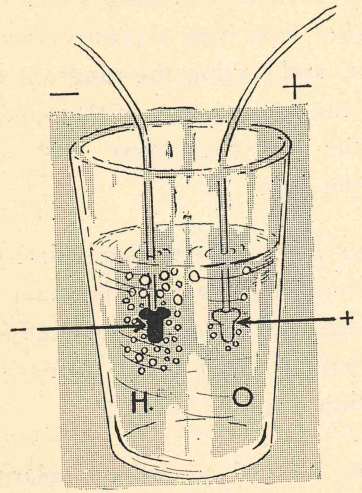


Fig. 1

Cords from positive and negative poles of galvanic current with tips immersed in a glass of water, showing the greater number of bubbles at negative pole.

direct current since the plug which enters the light socket taps both a positive and a negative inlet, and, taking the plug out and turning it so the prongs enter in the opposite manner to the way they were, will reverse or change the poles.

Another method of testing polarity is with moist litmus paper, when it is found that blue litmus turns red from the acid effect of the positive pole and red litmus turns blue from the alkaline negative pole.

Another method of telling polarity is to watch the swing of the needle in the meter. If it swings to the right, the right hand binding-post will be the positive pole; if to the left, the left is positive.

Action of the Poles. Since the two poles are exact opposites it is plainly seen that their effects, likewise, must be absolutely contrary,

and, if a mistake is made and the wrong pole used, undesired and even serious results may follow. The action of each pole is as follows:

Positive

Acid.

Attracts oxygen, therefore will corrode metals.

Vaso-constrictor. (Causes contraction of blood vessels).

Stops bleeding. (Because of contracting the blood vessels).

Has a general constricting or hardening and drying action on the skin and tissues within its range; contracting pores, lessening the action of sweat and sebaceous glands, etc.

Because it is an acid caustic if used in surgical electrolysis, leaves a hard scar, therefore never employed in removal of hair, moles, etc.

Soothing. (Sedative.) Tends to allay inflammation and to soothe pain.

Germicidal from its acid reaction.

With copper, zinc, mercury and most metals, small particles are driven off and may be sent into the skin. (This is because these metals are positive and are repelled by the positive pole.)

Negative

Alkaline.

Attracts hydrogen, but having no oxidizing power will not corrode.

Vaso-dilator. (Dilates blood vessels.)

Increases bleeding.

Has a softening and liquefying action and is the pole **always** used by beauty culturists in removal of hair, moles, etc.

An alkaline caustic and in electrolysis leaves a soft pliable scar which ordinarily is scarcely to be seen.

Irritating. Sets up some inflammation.

Has no destructive effect on most germs, rather tends from its alkaline action to favor their development.

Does not affect copper, zinc, etc.

The acid which forms in the skin at the positive pole is hydrochloric acid (HCl); the alkali at the negative, caustic soda (NaHO).

Experiment. For a simple and convincing experiment, take two pieces of copper wire, long enough to handle conveniently, and attach one to the positive and one to the negative pole. Have a peeled, hard-boiled egg and insert the wires in opposite ends in the white of the egg (see Fig. 2). Turn on 15 or 20 milliamperes of current and let it run for 20 or 25 minutes.

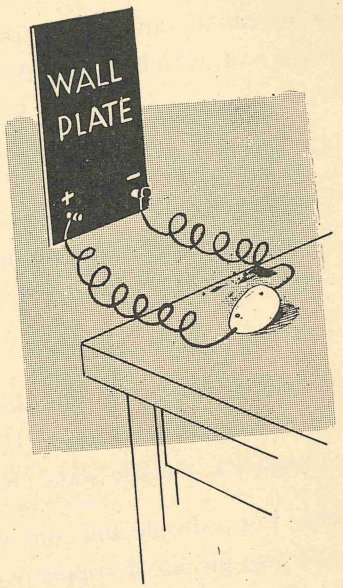


Fig. 2

In Fig. 2, we see the action of the poles by inserting a copper wire from each pole into a hard boiled egg. The copper is driven off from the positive and is seen in the white of the egg. No such effect is observed from the negative, although both wires are copper. The hardening action of the positive, and softening and liquefying effect of the negative, are plainly shown.

Remove the wire carefully from the egg. Note that the positive sticks and usually pulls away some of the hardened egg. Observe that there is a little discolored ring or zone around the positive where the copper has been driven into the white of the egg, and that the area feels hard to the touch.

The negative wire slips out easily, there is no discoloration but a tendency to a softening and liquefying of the egg white.

Sources of Current. The Primary Cell, the Dry Cell, Batteries and Wall Plates. Beauty culturists usually derive their galvanic current from a wall-plate, and many have the type of plate used in physicians' offices. Ordinarily both galvanic and faradic currents are furnished by the same apparatus, and a few operators have machines that also give the sinusoidal current. These are operated directly from the electric lighting circuit.

Originally galvanism was produced by the chemical action occurring in either a wet or dry cell battery, and this form of current is really the smoothest. Many still use the dry cell equipment.

It is unnecessary to describe all methods of generating the current, but it is desirable to understand the action of the simple galvanic cell (see Fig. 3).

The galvanic current is known as the direct or constant current; the bi-polar current; the low voltage or low tension current, etc. It is always flowing from a higher potential (voltage) to a lower one. A higher to a lower level, and does not keep changing or constantly reversing its direction, as is the case with the alternating current.

Potential is a term that represents essentially stored-up power that is ready to act, but has

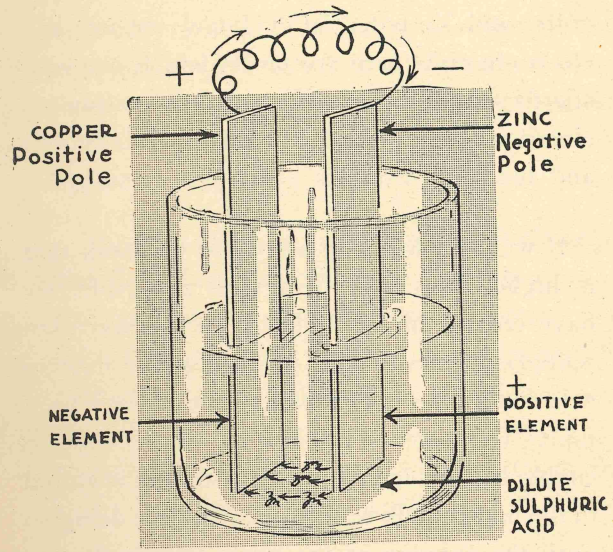


Fig. 3

Galvanic Cell

not yet started to do so. It is measured in volts, and so potential, voltage, tension and electro-motive-force are terms which one constantly meets in reading articles treating on electricity, and which are all essentially one and the same thing.

If we raise water to a level in one tank that is higher than that in a tank alongside, we have created in the higher tank a power (potential) or energy that will cause the flow to a lower level if the tanks are connected by a pipe. Until a valve is opened in the pipe to enable the water to flow, the potential is stored in the higher tank ready to act but not doing so until the opening of the valve affords the opportunity.

In the simple galvanic cell two different metals are placed in a solution which will have a chemical action on one of them. Carbon

may take the place of one of these metals, but ordinarily a strip of copper and a strip of zinc are used and immersed in a sulphuric acid solution. Here a difference of potential exists which results in a flow of electrons from the higher to the lower level.

The two strips of metal are called **elements** and the solution is called the **electrolyte.** The zinc and copper elements are connected outside of the solution, where each represents one pole of the cell. Within the solution a process of chemical decomposition and separation is going on, as the sulphuric acid attacks the zinc. In other words, electrolysis.

This causes a flow of electrons from the zinc to the copper, because a higher potential has been liberated from the zinc. **Within the solution,** the end of the **zinc strip or rod is positive** and the **copper negative. Outside** of the solution, since these electrons have so to speak

been forced through the copper and move along the connecting wire toward the zinc, the **copper has become positive** and the **zinc negative.**

It is this fact which causes so much confusion in the mind of the student. The ends in the solution are known as the positive (zinc) and negative (copper) elements. Outside the ends are called **poles** and the copper is positive and the zinc negative.

When we are talking of a positive and a negative pole, we are always referring to the ends **outside the solution.** An easy way to remember the polarity here is to note that coPper contains P for positive and ziNc has an N for negative.

Dry cells are usually made with an outer sealed shell of zinc, containing the electrolyte in a paste instead of a liquid, and within this

carbon and dioxide of manganese. The zinc is, as in the wet cell, the negative pole and the carbon the positive.

A **battery** consists of a number of cells connected to one another. If connected positive to negative, as carbon to zinc, it is called connecting in **series** and gives **greater voltage.** If all of the zincs are connected together and all of the carbons together, it is called in **multiple** or in parallel and **multiplies the amperage.**

NOTES

A wall plate is a apparatus that converts electric current from the socket to the patron into a form which may be used for massage purposes.

A complete circuit is a complete path of a current performing action.

Test for Polarity
Attach cords to the binding posts
Turn on the current

CHAPTER THREE

Electrolysis. Destruction of Hair, Moles, etc. with the Galvanic Current

Electrolysis. We have already seen that the polar effect of galvanism is to separate the elements in a solution and thus perform electro-chemical analysis. Abbreviate this to electro-analysis and then to **electrolysis,** and the origin and meaning of the term is plain.

This action only takes place in a liquid or semi-liquid substance and not in a dry solid or substance. **Some moisture must be present.** The solution or substance acted on is called the **electrolyte.** From this it will be seen that we can get an electrolytic action on the soft

tissues of the body, but not on bone. It also shows the reason for soaking a callus or a hard wart before attempting electrolysis, in order to have enough moisture to make the latter possible.

Surgical Electrolysis. The use of the galvanic current for the removal of superfluous hair, for the destruction of moles, papillomas and other small growths, and for the obliteration of small veins has been successfully carried on over a period of many years. At the present time it seems to me that in the removal of moles and other growths, the high frequency current either in the form of fulguration or desiccation is preferable to electrolysis, and that technique will be given in Chapter Nine. **In the destruction of undesired hair,** nothing has ever proved so satisfactory and as generally successful as the use of the electric needle.

The principle employed in electrolytic destruction of hair is the introduction of the needle **(always on the negative pole)** into the hair follicle or papilla and the cauterization of the follicle by the caustic soda which is produced at the negative pole. The patron may be treated either while sitting or lying down, according to the position which makes it easier for the operator to get at the area where the hair is to be removed.

The positive pole is attached to a good-sized pad or electrode which has been thoroughly soaked in hot water. If a little salt is added to the water it makes it a better conductor of the electricity, but it must only be a tiny bit. (Proportion: a teaspoonful of salt to a pint of water.) The pad used is ordinarily about 4x6 inches, though some use one only 3x5. It is known as the **indifferent** or **dispersing electrode** and should be always sufficiently large to

admit of plenty of current being carried into the circuit without being felt from the positive electrode itself.

Sometimes the pad is bound on the patron's arm; sometimes the palm of the hand rests on it; and if in a recumbent position, it may be placed between the shoulder blades with the body weight insuring good contact. Many experts place the positive electrode in a bowl of water and the patron dips her hand into this.

The **smaller electrode** in any electrical application is always known as the **active electrode** and the dosage in milliamperes is always in accordance with the sensation or tolerance at this pole. In this case, the negative pole is a needle.

We have previously stated that electricity, like water, seeks its level in pressure (voltage); therefore, it spreads out evenly

through the circuit; consequently, **irrespective of the difference in size of the two electrodes used, there is just as much current coming through one as through the other**; just as much through the needle as through the large pad. The difference is that with this current spread out over the surface of the pad, it is not as dense nor as highly concentrated over any small spot as it is when it all has to go through the small area offered by the needle.

The needle may be an ordinary steel sewing needle, but needles of platinum are preferable. Bulbous pointed needles have been very popular because the bulb prevents penetration below the follicle, but since the greatest intensity of current will be where the smallest diameter exists, the pointed needle will localize it in the end of the follicle. Pointed needles are used more than the bulbous at the present time, although it means that greater care must

be exercised in order to avoid too deep an insertion.

The technique herein described is that with the use of the single needle, because the method seems to be more easily demonstrated in this manner. In many schools only the multiple needle method is used or taught.

The needle is held in a straight needle-holder with a socket at one end into which the negative cord tip is inserted, and the needle itself is securely held at the other end in jaws that are opened or closed by means of a small screw. In some cases a small magnifying glass is attached to the shaft of the holder to make it easier to see to insert the needle in the hair follicle. I believe a separate magnifying glass is preferable.

If you will carefully observe a hair you will note how it bends or curves over in a definite

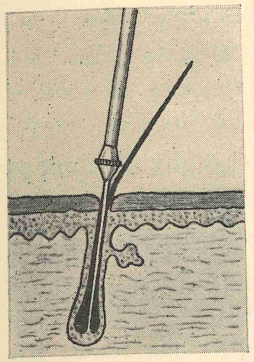


Fig. 4

Introducing the needle correctly into the hair follicle.

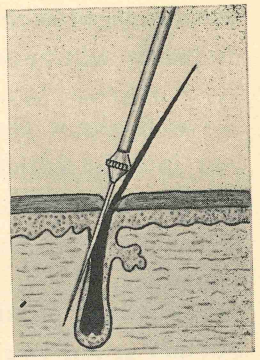


Fig. 5

Needle does not follow shaft, and hair will not be destroyed.

direction. Ordinarily the same curve follows down into the follicle, and so the needle should be introduced with this in mind. The depth ordinarily will be about 1/16 to ⅛ of an inch.

The needle is passed along the shaft of the hair into the follicle. The slight obstruction offered at the end of the follicle is a guide to the depth.

The whole question of success or failure is whether or not you succeed in introducing the needle into the follicle. (See Fig. 4). At times the needle will be pushed in too deep; at others the follicle is not in line with the curve of the hair shaft. (Fig. 5). Thus the needle fails to enter the follicle and it is not destroyed. I find that rotating the needle after insertion helps to show whether it is in the follicle. If it is, the rotation is noticed in the shaft. Of course this is not entirely reliable.

When satisfied as to the position of the needle, turn on **slowly** 2 to 5 milliamperes of current and let it stay on for 20 to 30 seconds. The dose will vary according to the coarseness of the hair, and the consequent variation in the size of the follicle. For many cases 3 milliamperes is plenty, and occasionally it will take more than 5. The smaller the dose while still having it effective, the smaller and less noticeable will be the tiny scar left. The required amount for the individual case will be ascertained after two or three hairs have been removed. As the current passes, a little hydrogen gas will form tiny bubbles around the shaft. After 20 to 30 seconds, turn the current off **slowly** and take hold of the hair with a pair of tweezers and pull gently on it.

If the needle has been properly inserted and sufficient current used, the hair will pull out easily with the whole follicle attached, and it

will be seen to have a black cauterized spot on the end. If the hair does not pull out easily, instead of forcibly removing it, put the needle back in for another 20 or 30 seconds. The hair may as well be pulled out now, and it may then reveal the fact that you were not in the follicle. Therefore, the shaft pulls away, the follicle is left, and the hair will grow again. It will be two or three weeks, though, before it will have grown enough to be distinctly noticeable, so if you are told in a week that certain hairs have returned you know that such a thing is impossible in that short time.

Fortunately we have a means of knowing. Following the use of the needle there will be a tiny ring-like scar which is scarcely perceptible to the eye but easily seen with a magnifying glass. If a hair is found with such a scar or ring surrounding it then it is a return, but if no scar exists the needle can never have been used on that hair.

In turning the current on and off be careful to do so **slowly,** otherwise the sudden change in the volume of the current will give the patron a **slight shock.**

The pain attending electrolysis is ordinarily a very slight stinging sensation, easily borne by the patron. Around the corners of the mouth and in any place where the needle comes relatively close to a fair-sized nerve, the pain will be much greater. Some individuals are also much more sensitive than others. At times the person is anticipating a lot of pain and greatly exaggerates the sensation felt. Usually a half hour sitting is about enough at one time although many individuals do not object to a longer session. For persons with a hypersensitive skin, where the pain seems difficult to bear, several methods have been tried. One is the use of a small, thoroughly soaked pad electrode over the area to be treated, which

is attached to the **positive pole** to get its soothing and pain-relieving effect. Another is to put cotton or gauze under this electrode, soaked in a 2% butyn solution and thus secure a local anæsthetic action. Under a physician's supervision, a 1% cocaine solution has been employed in the same way, from the positive pole. The application in such case calls for about 5 to 10 milliamperes of current and about a 15-minute session. Ointments containing local anæsthetics have also been employed. In any of these unusual type cases it is desirable to have a physician's advice.

Because of the peculiarities in the relative position of the hair follicle, it has always been considered that a good operator might have 30% of failures; that is, of 100 hairs removed, there would be 30 returns. I know a number of operators who are so skillful that they have only 10 or 15% of returns.

There are several types of electrodes affording the use of **several needles for more rapid work.** At first the operator should become thoroughly competent in the use of the single needle. In using the multiple needle electrode, where the needles are loose on short cords, it frequently happens that the weight of the loosely secured needle causes it to pull to one side and burn the hair off without getting the follicle. For this reason, a form in which the needles are securely held, just as much so as if held in the holder, is my preference. Ordinarily they are on cords, suspended from the machine. **Skillful** operators thus remove an astonishing number of hairs in a short time, but emphasis must be placed on the word "skillful."

When we remember that the negative pole is not germicidal, we see at once the desirability of using an antiseptic over the area treated,

both before and after the sitting. There will be a little oozing at the various points where the needle has been inserted, drying into little scabs. Patron should be cautioned about rubbing or fussing with the places because of the chance of infection.

If a number of hairs are removed in the same region and, therefore, close together, this spot may be sore and inflamed, for you remember the negative pole sets up a little inflammation.

In the removal of moles and other small growths, the needle is used on the negative pole. It is passed through the base of the growth **exactly at the level of the skin.** This is of the utmost importance as separation will take place where the needle has been inserted, and if this is above the skin level a raised stump will remain. In a small, soft growth on a pedicle (stem), as is found frequently in

papillomas, a single insertion may be all that is necessary, but where the base of the growth is larger, as in most moles and warts, several times will be required. (Figs. 6 and 7.)

What we are doing with the needle is liberating **caustic soda** which destroys the blood-vessels supplying nourishment to the growth; thus our needle must be inserted enough times and close enough, to secure completely this destructive action on the blood-supply. When this has been done there is nothing for the growth to do but shrivel up and drop off because its food supply has been completely cut off.

With the needle inserted, a sufficient amount of current is turned on to cause some bubbling of hydrogen at point of insertion. Usually 3 to 5 milliamperes are sufficient but up to 10 may be required. The needle is left in place

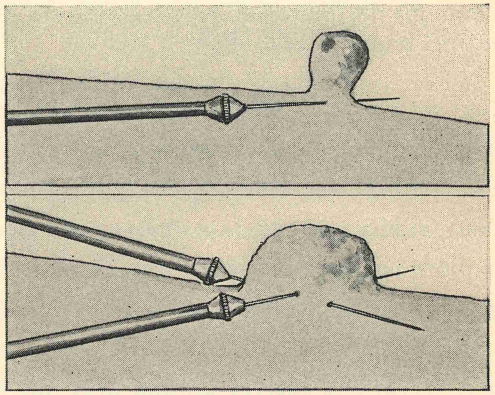
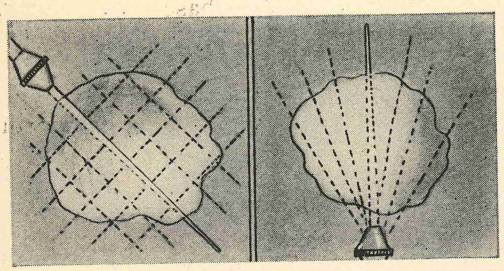


Fig. 6 and Fig. 7

For a small, soft growth on a pedicle, a single insertion may be all that is necessary. When the base of the growth is larger, as with most warts and moles, several insertions will be required.



Figs. 8 and 9

"Checker-boarding" method at left, and "fan" method at right.

about one minute to a minute and a half at each insertion.

After covering the base with insertions close together and parallel to one another, then do the same at right angles to the first insertions. This is called "checker-boarding." (Fig. 8.) In my "fan" method the needle is inserted and held for the usual time and then drawn nearly, but not quite out and thrust through again. (Fig. 9.) The various places it enters resemble the ribs of a fan, hence the name. Its advantage lies in not having to remove the needle until the work is completed and thus avoiding the necessity of turning current on and off for each insertion.

As the shaft of the needle may be in contact with the skin outside of the growth, causing some electrolytic action, it is desirable to prevent this by slipping a little sheet rubber or other insulator under the shaft, so that none of

the skin outside of the growth will be acted on. The only logical objection to this method is the prolonged action taking place at the point of insertion. An antiseptic solution is to be used before and after treating the growth.

Some oozing will take place following the application, and then the formation of a crust or scab. This ordinarily separates and comes away in 7 or 8 days, leaving a red spot which gradually fades out white. The scar is slight, often imperceptible, and is soft and pliable.

Patrons must be cautioned about leaving the crust entirely alone; passing around and avoiding it when washing or applying creams. If the scab is rubbed off a fresh one forms, which, in healing, may result in a slight elevation above the surrounding skin; whereas, if left alone it comes away leaving an even and level surface, provided, of course, that the needle has been properly introduced at the skin level.

When a growth does not come away even after 10 or 12 days, it should be lifted off. The area underneath it will be found to be completely healed.

In treating places where small veins have broken leaving a small spot such as we frequently see below the eye, it may be destroyed by inserting the point of the needle and turning on 2 to 5 milliamperes of current for about one minute. The spot will whiten out under the action of the current. Of course, as before, the negative pole is the active one. Sometimes the spot is large enough to require more than a single insertion of the needle-point.

In treating the varicosed veins found in red nose, (Acne rosacea), a piece of fine platinum wire a little over an inch long will be found better than a needle, because it may be bent a little and will follow a vein farther than is possible with the needle. 1 to 3 milliamperes of

current. The blood will be seen to leave the vein as the current is turned on.

Finally, let me again emphasize the point that all of this is surgery by electricity and should be done by or under the direction of a physician. In the latter case the operator becomes a skilled technician carrying out the doctor's instructions.

Batteries.

NOTES

A cell is composed of
zinc and carbon.
Wet & dry cells.
The carbon is the positive.
The zinc " " negative.
Two or more cells
connected together form
a battery.
Galvanic and Faradic
are produced by cells.
A wall-plate is operated
by the current from the line
and a battery produces its
own current by cells.
Direct current.

CHAPTER FOUR

Cataphoresis and Anaphoresis

Cataphoresis is the driving of a positive element or substance from the positive pole into the skin or tissues. It results from repulsion offered one another by elements of like polarity, possibly aided by the attraction offered by the opposite pole toward which the current is flowing.

In Chapter Two we referred to an experiment with copper wires inserted into the white of a boiled egg to show the action of the two poles. In this experiment copper is driven off from the wire on the positive pole and deposited in the area around the wire. Copper is

a positive element and, therefore, is released at or driven off from the positive pole. The same will take place if any other positive element is placed on or composes this pole.

If we place a piece of cotton or gauze on this pole which has been soaked in a solution, the positive part will be driven into the tissues while the negative part will be held there.

If we wish to introduce a negative element, like iodine, for instance, we would have to place our solution containing it on the negative pole. This would be **anaphoresis.** Both of these processes are also called **ionization.**

In either case the other electrode or pole is usually placed as nearly as possible opposite the one from which the element is being driven or repelled. This is really unnecessary, and the indifferent electrode may be at any convenient point, not too far from the active one.

When solutions are used they must be very weak, not over 1 or 2%.

There is often confusion over the terms cataphoresis and anaphoresis. This is because the prefixes **ana** and **cata** are applied to the positive and negative poles, the positive being known as the **anode** and the negative as the **cathode.** Thus it would at first appear that cataphoresis should be from the negative pole because of the use of cata. As a matter of fact the terms refer to the pole **toward which the element is traveling** and not the one from which it originates.

Here is the explanation. Ana means "up" and cata means "down." Phoresis is from a Greek word meaning "bearing." Therefore, cataphoresis means bearing down. The substance or solution is placed on the positive pole (anode) and flows downward toward the negative pole (cathode). That is because we

create a higher voltage or pressure at the positive pole. Theoretically, at least, in anaphoresis a negative element on the negative pole (cathode), is being borne back (up) toward the positive (anode).

The essential or vital point to be remembered in either of these processes is that the solution from which the element is driven must be placed on the pole, **corresponding to the polarity of the element itself**; positive pole to drive out a positive element; negative pole to force out a negative element.

Solutions of the metals, like copper, zinc, etc., are placed on the positive; for iodine, salicylates, etc., the negative.

Local anæsthetic solutions like butyn, cocaine, etc., would be on postive. I have examined a number of formulæ for bleaches, astringents, lotions, etc. Nearly all would be used on the positive pole.

CHAPTER FIVE

The Faradic Current

Faraday. There was celebrated in London, September 21st to October 3rd, 1931, the Faraday Centenary, commemorating the discovery in August, 1831, of Electro-magnetism and Induction by Michael Faraday.

Faraday is known as the father of the electrical industry because without his discovery we would have no motors, no dynamos, no transformers and therefore no commercial electricity. He was knighted for his discovery.

The Electro-magnet. Everyone is familiar with the natural magnet which attracts and holds pins, needles and other bits of metal.

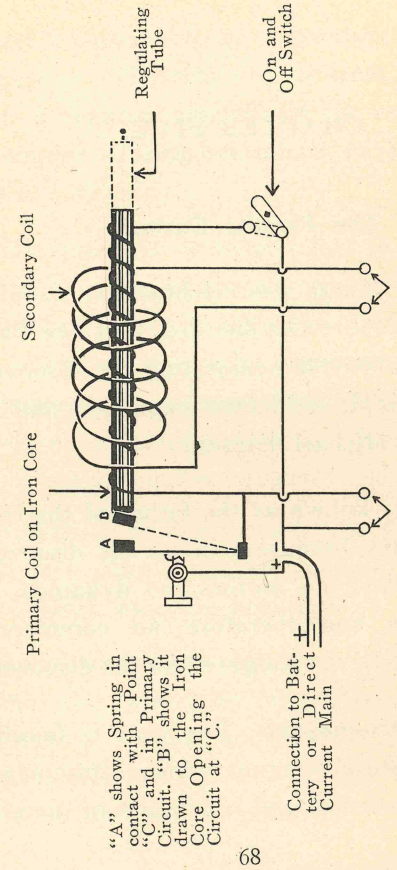


Fig. 9a Diagram of Faradic Coil

The electro-magnet is produced by winding a number of turns of wire around a core of soft iron and passing a galvanic current through this coil of wire. (See primary coil in diagram, Fig. 9a.) Immediately the current passes the iron bar acquires magnetic properties, and the instant the current ceases the bar loses its magnetism.

Induction. If we place another coil of wire around, **but not touching** the first coil at any point, when the current is passing through the first coil, a current will be produced **(induced)** in the second coil. This influence effect is called induction. The second coil may be around, inside, alongside or end to end with the first coil, and induction will take place as long as they are in line with one another. If, however, the second (secondary) coil is turned at a right angle to the first (primary) coil, induction will not take place.

The Faradic Current. In the faradic coil, (See Fig. 9a), the primary coil is that of the electro-magnet; a coil of coarse insulated wire wound around a bar of soft iron, as shown in the diagram. The coil is attached to the poles of the galvanic battery and in the circuit is placed a spring with a small facing of iron, by means of which the circuit may be interrupted; that is alternately opened and closed. Therefore, the current in the primary is an **interrupted galvanic current,** flowing in **one direction.**

When the current is turned on the iron core of the primary coil becomes a magnet and draws the spring to it, as in position B in the diagram. As the spring is pulled forward it ceases to make contact with point C and **opens** or **breaks** the circuit. The effect of this is to cause the iron core to lose its magnetism and it cannot hold the spring which flies back to

touch point C again and **close** or **make** the circuit, when the iron core again becomes a magnet and pulls it forward. In this manner the primary galvanic circuit is rapidly opened and closed, the vibration of the spring interrupter producing the buzzing sound heard with this current. When the current is passing in the primary coil a current is induced in the secondary. This current at first flows in an opposite direction to the primary current, but when the primary is broken it flows in the same direction. Thus by "making" and "breaking" the primary one-way current, we induce in the secondary a current that flows first in one direction and then in the other.

This then is the method of changing from the direct to the indirect or alternating type of current. The secondary or induced current is the faradic current, and because it is constantly changing its direction it possesses no fixed

polarity and is therefore incapable of accomplishing chemical results. The elements a pole would attract one instant it would repel the next, as the polarity changed.

The voltage of the faradic current is high as compared with the galvanic current, sometimes even as high as 30,000 to 40,000 volts, but with low amperage usually one milliampere or less.

Action of Faradic Current. This current is a mechanical or exercise current; each "make" and "break" furnishing the stimulation necessary to produce a muscular contraction. However, the changes occur so fast that no opportunity of relaxation exists, consequently the contraction is maintained and is said to be "tetanizing" in character.

The "break" current is sharper or stronger than the "make" current, and produces a more

vigorous contraction, and if very much current is used, a painful one. The difference in the two contractions produces an irregularity of the current and we have, therefore, **great irritation with slight stimulation.**

It is on this account that with medical men the sinusoidal current has largely taken the place of the faradic current, because it is smooth and symmetrical, thus permitting more current to be used than with the faradic before it becomes too irritating or painful. (Great stimulation with slight irritation.)

Too long applications of the faradic current may be followed by harmful changes in the tissues.

Used moderately and carefully it is a valuable muscle exerciser and developer, useful in wasted and flabby muscles. It tends also through its mechanical action to stimulate or

improve metabolism, which is the process of changing food into living cells or tissues.

In applying the faradic current the patron usually holds a carbon electrode attached to one terminal while the other cord fastens to a band around the operator's wrist, the current being applied through the finger-tips. Instead of this a brush, roller, or other form of electrode may be connected directly to this other terminal and passed over the desired area while held in the hand of the operator.

As confusion has sometimes occurred, it may be emphasized that the band electrode, the wrist-band electrode, and the cuff electrode; are all one and the same and are all wrist electrodes.

Two Currents from Faradic Coil. There has been so much confusion about the properties of

the faradic coil that I feel a final word is desirable. The faradic coil has two sets of terminals or binding posts, one set marked P (meaning terminals of primary coil) and the other marked S (secondary coil). The current from the P binding posts is an interrupted galvanic current and is not **a faradic current.** That from the S or secondary coil is the faradic current.

NOTES

Wet cell is formed by immersing in an acid solution two different materials connected by wire, each of which react to the acid but one more forcibly than the other.

Dry cell is formed by using a zinc cylinder packing a spongy substance saturated with acid next to it and placing carbon stick in center.

CHAPTER SIX

Direct and Alternating Currents; Frequency and Cycles Defined

Direct and Alternating Currents. In considering the galvanic current, we found that it always traveled in one direction, that is, from positive to negative. We may interrupt it, but each time it starts it passes in the **same direction.** (Fig. 12). Because of this fact it has been called the **Direct Current** (Fig. 10). It is a one-direction current, never changing its polarity. If it is never allowed to drop to zero in voltage, even though the voltage varies, it is called **Continuous.** If the voltage always remains the same it is called the **Constant current,** (Fig. 11). The voltage (potential) may

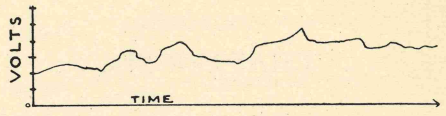


Fig. 10
Continuous Current

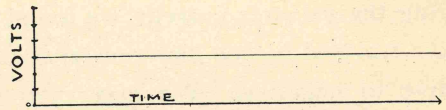


Fig. 11
Constant Current

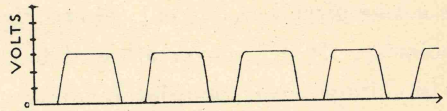


Fig. 12
Interrupted Current

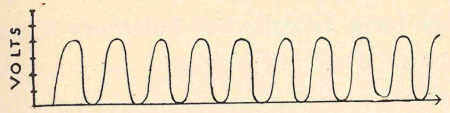


Fig. 13
Pulsatory Current

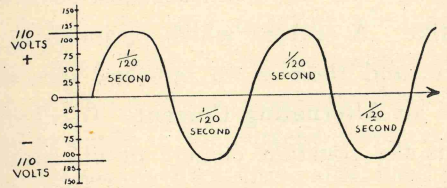


Fig. 14
Alternating Current

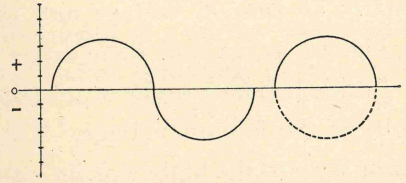


Fig. 15
Cycle Explained

vary in essentially regularly repeated cycles, and this form is called a **Pulsatory Current.** (Fig. 13).

In the faradic current we found that the current was constantly changing its polarity, swinging back and forth between positive and negative. A current which periodically flows in one and then in an opposite direction is called an **Alternating Current.** Its characteristic is the constant change or alternation in polarity.

In Fig. 14, it will be noticed that the current starts at zero in voltage and then rises to its highest point and then drops back to zero. In this instance we have purposely fixed 110 volts as the highest voltage. The current goes from zero to the highest point on the positive side and then completely reverses its direction and comes back to zero and then does the

same thing on the negative side. This complete reversal of the current, zero to zero, is known as an **alternation.** Two of these, one positive and one negative alternation make one **cycle.**

In Fig. 15, one cycle is shown and then in the dotted line the negative alternation is placed immediately below the positive in order to show that a cycle represents the **complete round or circle** of the current, from zero to as far as it goes on the positive side, back to zero and then to the far point on the negative and again back to zero.

The frequency of a current is the number of complete cycles occurring in one second of time.

In Fig. 14, we have arbitrarily placed the time at 1/120 of a second for each alternation and the peak voltage at 110 volts. If it takes

1/120 of a second for one alternation, then for one cycle or two alternations it will take 2/120 or 1/60 of a second, and if it takes 1/60 of a second for one cycle, in the whole second, 60 cycles will occur, and this is the frequency of the current we have diagrammed. In other words an alternating current of 110 volts and 60 cycles, which is the prevailing type of commercial alternating current throughout the country from which source most of us operate our electrical apparatus and our lights.

CHAPTER SEVEN

The Sinusoidal Current

The Sinusoidal Current. In the alternating current, all of the positive alternations are alike and so are all of the negative alternations, but the positive and negative alternations, although they are usually alike are not necessarily so. If they are all alike the current is said to be **symmetrical.** The sinusoidal current is a symmetrical alternating current of low voltage, and low milliamperage. It is a mechanical or exercise current, producing contraction of **both voluntary and involuntary muscles.**

It has largely superseded the faradic current because the symmetry of the current gives it

great smoothness and, with its comparatively gradual rise to and fall from its peak voltage, the muscular contraction is smooth, even and comparatively painless. Consequently a considerable amount of current may be tolerated by the patron, and thus we have **great stimulation with slight irritation,** whereas in the faradic current we had slight stimulation with great irritation.

The ability to use more current also makes it possible to contract a group of muscles instead of a single muscle.

Physiological Action. Since it is an alternating current, having no fixed polarity, it has no chemical or electrolytic effects; nor can it be used for cataphoresis or driving elements into the tissues. However an exercise or massage current accomplishes indirectly some things that would not at first appear to be within its scope. As muscles alternately contract and

relax there is first compression and then the contrary action on the blood-vessels, glands, etc., resulting in a stimulation of the circulation and increased activity of the glands. Furthermore the first essential to muscle contraction is the stimulation given to the nerve controlling the muscle, so nerve stimulation and improved nerve tone is another effect. Thus we may stimulate nerves, muscles, circulation, etc., and build up flabby or wasted muscles into normal, healthy, vigorous ones.

Here another feature enters in. If the reflex nerve stimulation is applied slowly to a muscle or with a pause between contractions, it may be kept up for some time without tiring the muscle; but if the contractions are brought on close together, then a tiring or fatiguing of the muscle soon results. In other words, by the frequency or rapidity of contraction, taken into consideration with the period of time, we may

get two entirely opposite effects, **stimulation** and **inhibition. Inhibition is merely overstimulation.** Moderate, not too rapid exercise, stimulates; rapid, or too long continued exercise, tires, fatigues or inhibits. So in applying these currents care must be taken that we do not over-exercise muscles that we wish to build up, or we will have exactly the opposite effect and weaken and tear them down.

Derivation of Name. The term sinusoidal comes from sine and from oidos, like, and the current is "like a sine," because it conforms to sine requirements. This all sounds very confusing until we find out what a sine is. Let us take a circle, as shown in Fig. 16, and draw in some of the radii, (a radius is a line from the center of a circle to its circumference, like the spoke of a wheel. The plural of radius is radii). Then lines ao, bo, co, do, to so, ro, wo all represent different radii. Now if we take two radii,

say ao and bo, we have an angle aob, between them; or if we take ao and co, we have the greater angle aoc. If we take the angle between any two radii and draw a line from the point where the one radius touches the circle, and make it perpendicular to the other radius, the line so drawn is the **sine** of the angle between the radii. Thus with aob the sine is bk; with aoc, it is cl. With wos it is sp. It is then apparent that if we draw in perpendicular lines in both halves of the circle, as in Fig. 17, all of these lines are sines of possible angles between the radii ao and wo and other possible radii, above or below them. Now all of these sines are limited by the rim of the circle, so all of the sines above the line aow are duplicated by those below the line, and if we have an electrical current that follows the circle (Fig. 18), we find that the curve ab represents an alternation going from zero to the highest voltage on the positive side and back to zero and then

doing the same, (curve bc) on the negative side. The two form one cycle.

Sinusoidal currents are mechanically made to conform to various combinations of sines, and to have the time of each cycle longer or shorter; to have a pause between each alternation; or to have the current held for an appreciable period when it is at its highest voltage. So we have rapid sinusoidal currents, slow sines, interrupted rapid or slow sines, etc. See Figs. 19-22.

It is unnecessary for the beautician to know all of these different forms, but, just as with medical men, these currents have displaced the faradic current, so in beauty and scalp work they are surely going to supplant faradism, and those who are first to recognize this and become familiar with sinusoidal currents will be first to benefit. Some of the forms which

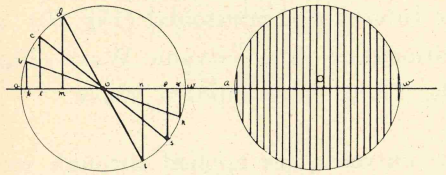


Fig. 16

Fig. 17

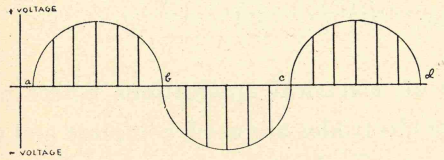


Fig. 18 (illustrating symmetry of sine current)

beauticians have been using are: 1. The Sedative Rapid Sinusoidal, (Fig. 19); 2. The Stimulative Interrupted Sinusoidal (Fig. 20); 3. The Nutritional or Slow Galvanic Wave (Fig. 21); 5. The Tonic Superimposed Wave.

The currents are applied through well-saturated pad electrodes, or in the same manner as faradic currents.

A number of special face and scalp electrodes have been devised in addition to the standard forms.

In all electrical applications where pads or metal electrodes are used, complete and perfect electrical contact is necessary to avoid unpleasant sensations.

The sine currents are usually currents of medium or low frequency. When the frequency is increased we usually say rapid frequency.

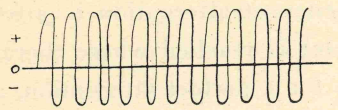


Fig. 19

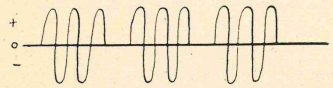


Fig. 20

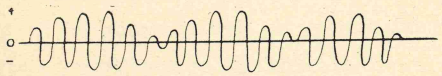


Fig. 21

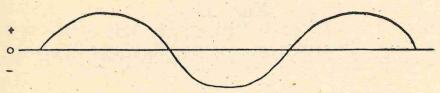


Fig. 22

Types of sinusoidal currents. Fig. 19 Rapid sinusoidal. Fig. 20, Interrupted rapid sinusoidal. Fig. 21, Rapid sinusoidal wave. Fig. 22, Slow galvanic wave.

If the frequency of alternation is greatly increased a point is reached where there is not enough time for a perfect alternation, and although the current swings alternately to the

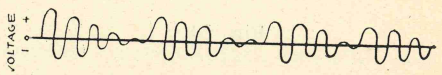


Fig. 23
The high frequency, or oscillating, current.

positive and negative sides, it does so with dwindling waves which we call oscillations, and we say the current is an oscillating instead of an alternating current. Fig. 23. This type

is known as the high frequency current and occurs when the frequency is around or above 10,000 cycles per second.

The current tracing is shown in the diagram and it may be seen that it reaches a maximum point and then dwindles down to zero and then repeats.

In high frequency currents there is a loss of sensation to the passing of the current because it is vibrating too fast to affect the sensory nerves. The same is true of motor nerves so there is no contraction of muscles.

Application of Sine Currents. Since the sine currents, like faradism, are exercise or massage currents they are in general applied in the same way that has been customary for the faradic current. This, ordinarily, is with the patron holding one electrode (usually a carbon electrode covered with wet absorbent cotton), the other a band or cuff electrode fastened around

the operator's wrist. Operator then manipulates or massages with current passing through finger-tips, taking care not to break the contact with patron's face or scalp while current is on, thus avoiding shock.

A wire brush may be used on scalp in place of the finger-tips, and in that case is connected directly to the machine. Also well-saturated pads, usually of spongio-felt, covering block tin, are applied to various muscles and areas. They should have wet absorbent cotton between the pad and the skin **for sanitary reasons** and also to insure **perfect electrical contact.** If perfect electrical contact does not exist in any electrical application, stinging or burning will result, so care must always be exercised to see that nothing interferes with the perfect conduction of the current into the skin. There are other standard forms of covered pad electrodes, of varying sizes, available for use.

The advantage of the sinusoidal current over the faradic current is in its greater smoothness; practical absence of any stinging sensation; greater stimulation or sedation; and deeper penetration.

The form most commonly employed by beauty culturists at present is the sedative rapid sinusoidal. In short applications, say 2 or 3 minutes, this form is stimulating and tonic in character, both to muscles and nerves. In longer applications, up to 10 minutes or so, it is distinctly sedative and soothing, in fact, quite definitely pain-relieving for sore muscles, ragged nerves, etc.

In using an exercise massage current do not forget that it has two distinct actions according to the nature of the application, that is, whether we have exercise or over-exercise. While short applications are tonic and upbuilding, long-drawn-out ones are relaxing and fatigueing.

As stated before, it is the difference between stimulation and over-stimulation (inhibition).

If a muscle is contracted and then the process repeated with a reasonable interval of time between, the exercise may be continued for some time before the muscle becomes tired. If the contractions are faster fatigue will result in a shorter time.

If stimulation and general toning of muscles and nerves is desired, and tissues are to be built up and strengthened; with more activity in the glands and in the circulation, shorter time and not too rapid contractions are employed. If pain-relieving effects and relaxation are sought, then longer applications are made and more rapid contractions are indicated.

NOTES

NOTES

CHAPTER EIGHT

High Frequency Currents

High frequency currents are oscillating currents with a frequency of 10,000 or more cycles per second. It is at this point that the current vibrates or oscillates so rapidly that it does not affect either motor or sensory nerves, hence neither muscular contraction nor sensation is produced by the passage of these currents through or over the surface of the body.

Further characteristics: In Fig. 23 the character of the current is shown. In comparison with galvanic and sine currents, they are high voltage currents. In comparison with one another, they are of high, medium and low volt-

age. There are **three varieties** of high frequency currents: **Tesla, Oudin** and **d'Arsonval,** being named for their originators. The form generally used by beauticians is the Tesla current. It is one of medium amperage and may be used as either a single or double terminal current. In skin and scalp work, the single terminal application ordinarily is employed.

High frequency currents have no fixed polarity, as they are constantly oscillating back and forth between positive and negative. That is why we say uniterminal or biterminal instead of unipolar and bipolar.

Since they have no definite polarity they are incapable of producing chemical or electrolytic effects, nor can elements be driven in with them as is the case with the galvanic current.

It is true they may aid in the absorption of lotions or creams, but this is only because of the local stimulation of absorption, plus—or as

a result of—the heat and increased circulation, and is not a chemical action like cataphoresis.

In the d'Arsonval current we have comparatively low voltage but very high amperage; and in the Oudin, the reverse, very high voltage but very slight amperage.

Remember that voltage indicates power of overcoming resistance and therefore the greater the voltage the greater the **penetration** of the current. Amperage means current intensity and **heat.** By thinking of voltage as penetration and amperage as heat, many problems are more easily understood. All of these high frequency currents are transformed currents. That is, they have been passed through a transformer, which raises the voltage of the original alternating current and at the same time lowers the amperage, because it is a fixed rule that in the process of transforming the current, when voltage goes up, amperage goes down. Reversely, when voltage is lowered, amperage rises.

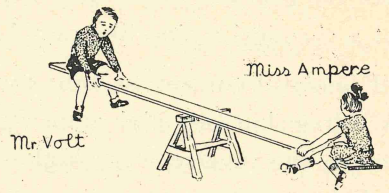


Fig. 24. Oudin current. High voltage; low amperage.

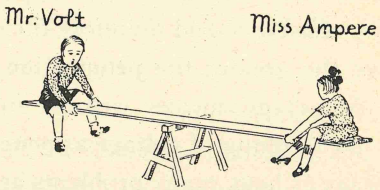


Fig. 25. Tesla current. Medium voltage; medium amperage.

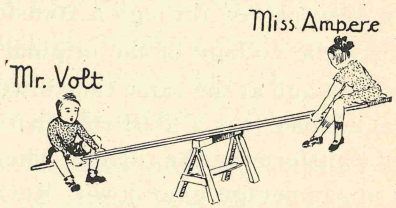


Fig. 26. d'Arsonval. Low voltage; great amperage.

The method of producing the currents will be discussed later, but in order to fix the difference between the three high frequency currents, firmly and unforgettably in the mind, I am using a simple illustration. Who does not recall some time in childhood days of playing "see-saw" with a board over a fence or other support and a child on either end of the board, see-sawing up and down? Now note that when one end of the board rises, the other comes down. This you see corresponds exactly to what takes place with voltage and amperage in a transformed current.

Now there are only three general positions in which the board of the see-saw may be placed. With one end high and the other low, and then this position reversed, or with the two ends fairly balanced between the high and the low point. If we will put Mr. Volt on one end of the board and Miss Ampere on the other, and go through the motions of the see-saw, we

will have the three different proportions found in the high frequency currents. See Figs. 24, 25 and 26.

With the various degrees of penetration and heat available, we may select the form of current which best suits our purpose.

The Oudin, with its very high voltage and slight amperage, has only small volume and therefore is used from a single terminal or electrode. On the other hand, the **d'Arsonval** has such a high amperage that it is always used with two electrodes.

The Tesla lies between the two and may be used as it is in beauty shops, with one electrode or—as in what is known as autocondensation (doctor's method)—with two electrodes. In other words, it partakes of the nature of its neighbor on either side.

What is a transformer? A transformer is a method of utilizing the principle of induction, by means of a primary and secondary coil for the purpose of raising or lowering the voltage of the current. Where the voltage is raised it is called a "step-up" transformer; when it is lowered it is known as a "step-down" transformer. Transformers, then, are induction coils.

There are two varieties, the open and the closed core type. In small high frequency machines the core of the primary coil is usually a bundle of soft iron rods and, as there is no protection of the ends; this is known as an open core. Because of the unprotected ends some of the current will leak off and is lost. In the closed core type, used in large medical and hospital machines, the core is made in the form of a frame or rectangle and is composed of flat plates of soft iron fitted together, and prevents the loss of current that occurs in the open core. Fig. 27.

The primary coil, consisting of a comparatively small number of turns of coarse wire, is wound around one side of the frame and is connected to the street current supply, which must be of the alternating type. It is ordinarily one of 110 volts and 60 cycles. In case the supply is the direct current, a rotary converter must first be attached which is a motor generator. That changes the direct current into the alternating type of current, which is then carried into the transformer.

The secondary coil of the transformer is wound around the opposite side of the frame. It consists of a comparatively large number of turns of wire, which is smaller than the wire in the primary in order to make it possible to wind on the greater number of turns. In my office machines, there are about two miles of wire wound in the secondary coil.

Now referring back to what was said in Chapter Five about induction, we know that

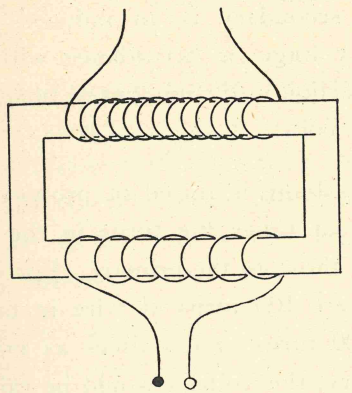


Fig. 27
Closed Core Transformer

there is no direct connection between the primary and secondary coils and that the current in the secondary is an induced current of higher voltage, in accordance with the ratio or proportion in the number of turns of wire in the two coils.

The voltage is raised in proportion to the number of times the turns in the secondary exceeds those in the primary. For instance, if there were 100 turns of wire in the primary and 1000 turns or ten times as many in the secondary, the voltage would be raised to ten times that of the primary coil.

The transformer is usually immersed in oil or other insulating medium to prevent any direct leakage of current across from one coil to the other. The wire of the coils is also insulated from the core. In small machines of the open core type, paraffin or wax paper or bakelite is used generally for insulation. In these

machines the voltage is usually stepped up to 15,000, 20,000 or even 25,000 volts. In the large office machines the point is usually around 35,000 volts.

Now this process of raising the voltage from the 110 volt street current to say 35,000 volts, has no effect upon the frequency of the current, which is still 60 cycles as in the street current. In other words we have a high voltage, low frequency current.

A condenser and a spark-gap are necessary to raise the frequency from low to high.

In Fig. 28 from my Physiotherapy Manual, is outlined the method of producing high frequency currents.

The low voltage (110 v.), low frequency (60 cycles), alternating current comes into the few turns of wire on the primary coil side of the transformer, inducing in the secondary a current of high voltage but still low frequency.

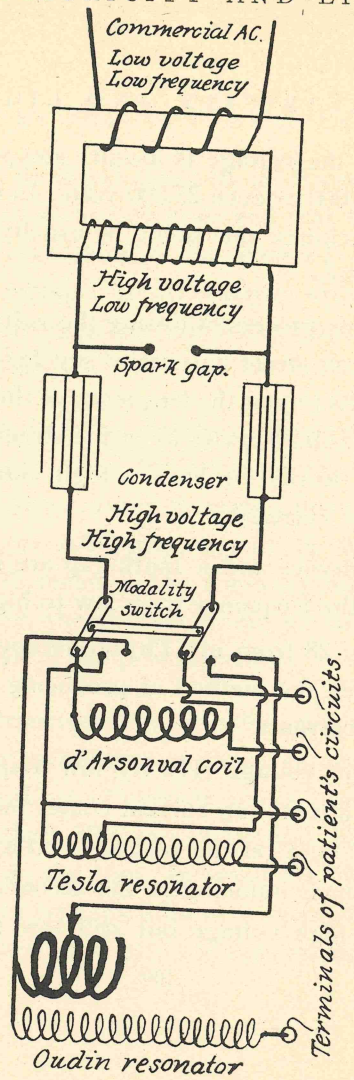


Fig. 28

Now if the spark-gap were closed the secondary circuit would be through it, but as it is opened to place resistance in the form of the air gap thus produced, it is easier for the current to pass into the condenser, which is a device for storing or building up a charge of the current. When the voltage of this condenser charge becomes high enough it gives it sufficient power to jump across the air space in the spark gap, the positive and negative charges in the condenser oscillate back and forth, producing the oscillating or high frequency current. Beyond the condenser we now have both high voltage and high frequency. (In this particular type of doctor's or hospital machine the voltage at this point is about 35,000).

Thus we see the **transformer raises the voltage** and the **condenser, by means of the spark-gap, raises the frequency.** From this point the

current is carried by means of a selector or modality switch into separate windings for the three different forms of current.

In the Oudin current the voltage runs from 50,000 or 60,000 volts up to as high as 90,000 or more volts.

This then calls for another "step-up" transformer and so another primary and secondary coil is added, the latter also being known as a resonator, and so the voltage is still further and considerably raised, while the amperage becomes correspondingly less.

In the Tesla form the voltage is already practically high enough, and the effect of the added primary and secondary coil increases it but slightly, but does produce a much smoother current.

In the d'Arsonval current one of only 8,000 to 12,000 volts is required, and so we have to

reverse our previous method and "step-down" our voltage which is done by a single coil of coarse wire, called a solenoid, and which is really a second secondary, to that of the original transformer. With its fewer turns of wire the voltage is dropped to the desired degree, but the amperage or heat greatly increased. That is why this current is used for what is known as diathermy, which will be described further on.

Small Tesla Outfits. The small Tesla, one-piece outfits which have long been in use for skin and scalp work, are small Tesla type oscillators, using the secondary coil current to excite glass vacuum or non-vacuum electrodes.

From these a spark may be drawn of varying length according to the size of the machine and the amount of current produced. The more current the longer the spark. This form, with the glass vacuum electrode, has often been

called the "violet ray." It is an **erroneous term** but has been used so long that it is difficult to get rid of it, but it should be corrected, as it causes confusion with ultraviolet rays, and any way the current is not a light.

The dosage of current to be used with the glass electrode is usually determined in accordance with the length of spark which can be drawn from the electrode, a rule which I originated back about 1901.

With a fixed amount of current coming through the machine it will be found that a spark of definite length may be drawn from the tube, say a quarter or a half an inch. If the spark is to be longer, more current must be put through the electrode; if shorter, less current.

I have always considered this a rather poor or inaccurate method, but in all the years that have elapsed since I originated it, no one seems to have devised a better one.

If, therefore, I wished to convey my idea about the amount of current to be used in treating the skin or scalp, I would say use current enough to make it possible to draw out a spark half an inch long, or one-third of an inch, or whatever might be desired.

This would not mean that you were to use the electrode far enough away to give a half-inch spark, but that that amount of current was available.

Actually, in nearly all cases, the electrode would be kept in fairly close contact with the skin, while passed back and forth, so that the patron would not feel too sharply the spark, and thus not be annoyed, where possibly the full-length spark could not be tolerated.

For skin applications, a flat-surfaced electrode ordinarily is employed. This type on the

scalp is apt to give a spark that is a little too sharp since the hair prevents the electrode from skin contact, so commonly for the scalp a rake-shaped electrode is used.

For beauty specialists' use, there is a growing tendency toward using the larger portable apparatus, which should be encouraged, as with increasingly efficient machines, better results will be obtained.

General Action of High Frequency Currents. In our original classification, these currents were placed under the heading of physical measures producing heat, and this is the outstanding action of high frequency currents. They have no contracting or exercising action on muscles, and produce no sensation in passing through the body. They have no fixed polarity, so no definite chemical action.

Locally applied with the glass electrodes, they liberate quantities of free oxygen (ozone)

and probably in all forms have a definite oxidizing effect. The sparks are germicidal.

The local application of spark or effleuve (very faint, mild spark) causes, for an instant, slight blanching of the skin, followed so promptly by a distinct reddening, (erythema), that the first effect is usually unnoticed. Thus the final effect is that of determining a greater amount of blood to the area treated, which is called hyperaemia.

Nutrition and metabolism are beneficially influenced. When the whole body is subjected to the currents as in the method known as autocondensation, there is an actual rise in bodily heat, as may be shown by a clinical thermometer, together with increased elimination through skin and kidneys, and lowering of blood pressure. In diathermy a greater amount of heat may be produced within the body, than that on the skin surface.

When the current is used with a small metal point it may be so concentrated that drying, burning or cooking of tissues results. These methods are known as **desiccation, fulguration and coagulation.** The technique will be given in Chapter Nine.

CHAPTER NINE

Destruction of Moles, Etc., With Desiccation or Fulguration; Indirect Tesla; Care of Electrodes, Etc.

Fulguration and Desiccation. The best methods we possess today for the destruction of moles, warts and other small growths are desiccation and fulguration. The technique of these two is the same and by many the terms have been looked upon as having the same identical meaning.

The difference is that in desiccation we have a drying or dehydrating action and in fulguration a burning effect. The Oudin current, because of slight amperage, is the one for desiccation, while the Tesla with greater amperage

produces fulguration. Since most cosmeticians have only Tesla machines, it is fulguration which they employ.

The method of use is with the needle or fine-pointed metal electrode. Send enough current through to produce a spark one-eighth to one-quarter inch in length, being governed by the sharpness of the spark and the sensitiveness of the patron.

The needle is brought near enough to the growth for the spark to jump to the surface, and then quickly drawn back beyond sparking distance. This is then repeated over and over, going first **around the edge** and then over the surface of the growth with these interrupted sparks.

The reason for the slight interval between the sparks is to make the application less painful. Few can stand a continuous spark. The

pain ordinarily is not severe with the technique given.

If the spark is sufficiently powerful a little brown spot will show its burning action on the skin.

The sparking must be kept up long enough to insure penetration of the whole growth. If it is a soft growth like a papilloma or an ordinary mole, there will not be any difficulty and usually a lighting up of the growth will indicate penetration. Papillomas shrivel as the moisture is driven out by the heat of the spark. Again I call attention to the fact that beauty culturists have no authority to treat papillomas so doctor should be consulted.

When they are on a pedicle or stem, only the stem need be treated. When through with the fulguration the growth may be left to come

away of its own accord, which will occur in 7 or 8 days, or it may be removed immediately by means of a sharp razor blade, thus leaving a perfectly flat surface over which a slight crust or scab will form, which, in turn, will come away in 7 or 8 days. The area will be red at first, but later clears up leaving little or no trace.

Moisture in the growth is necessary to the successful action of the spark. In hard growths like callouses and many warts, where there is little moisture, it will be found difficult to obtain much effect from the spark. In these cases soaking the area for 20 minutes in hot water to which a little salt or soda has been added, will aid.

I often treat the surface, getting a slight penetration and then shave off the layer that has been fulgurated and then keep on repeating the process until finally down to the skin level.

It is very important that the sparks absolutely follow the edge of the growth that one may not find that, after the main growth has been removed, a little raised ring remains. To make it possible to absolutely localize the action of the spark on the growth itself without affecting any other part of the skin, I have devised a localizer consisting of a flat sheet of metal with various sized openings in it to make it adjustable to various-sized growths and with a curved end that makes it possible to treat the edge of any growth. See Fig. 29.

At the same time the metal rapidly conducts away the heat of the spark and so decreases the painfulness of the application.

Indirect Tesla. If the patron is connected to the machine by holding a metal rod in the hands, an indirect spark may be drawn from the patron by the operator's fingers; by a glass

electrode held in the hand; or by the fulguration needle held in the operator's hand. Provided, of course, that the apparatus furnishes

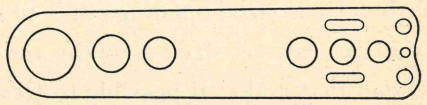


Fig. 29. Author's Fulguration Localizer.

a sufficient volume of current. More and more beauticians are coming to use the larger doctor's type portable and office size machines which makes possible more efficient work.

With these machines my special type of indirect Tesla is possible. A thin auto-condensation pad is placed on a chair and the patron seated on it. The pad is connected to the large knob of the Tesla, and sufficient current turned on to completely saturate the patron's body. Sparks are then easily drawn out with fingers or electrode, and, if too long, placing the other hand in contact with patron to sidetrack part of the current will make it possible to use a long, medium or fine spark at will, without readjusting the setting of the machine. The operator acts as a "ground" to carry off the charge in the patron's body. If a firm contact is made with the finger tips, the escape of the current through this small area will result in

sufficient concentration to make the amperage or heat of the current very intense, making it possible to use it in many conditions where this localized heat is desirable. This has been called by some, indirect diathermy instead of indirect Tesla.

Autocondensation is a method of using high frequency currents employed by physicians and requiring larger apparatus than is usually employed by cosmeticians. The patient lies on a special pad which is attached to one terminal of either the Tesla or the d'Arsonval circuit, while the patient is connected to the other by a metal electrode. The pad consists of an insulating material (di-electric), with a metal condenser layer beneath. The body of the patient takes the place of another condenser layer. Opposite charges of static electricity are momentarily held in the body and in the metal plate. With the oscillation of the current, the charges are rapidly reversed or alternated.

Tesla autocondensation aids in the carrying off of poisons and waste, and in the absorption of deposits. It generally increases the activity of the various functions of the body. D'Arsonval autocondensation increases the body temperature more than the Tesla form because it has more amperage. Both have the effect of lowering blood pressure.

Diathermy is another medical use of the d'Arsonval current where, by the use of two metal electrodes heat may be approximately localized or produced within the body to a greater degree than by any other method known to us at the present time. It has proved a valuable measure for doctors to use but does not come within the beauty field.

Care of Electrodes. Electrodes used in this work must be carefully cleansed or sterilized. Exercise the same care you would employ if you were going to use them on yourself.

Caution. Remember that the high frequency spark is positively and absolutely germicidal. Also that it contains a **definite amount of heat.** You can light a gas jet with it; therefore if you are using lotions in connection with the current, which are inflammable, use the spark first and apply the lotion afterward. For example, lotions with a high percentage of alcohol. Fine fuzzy hair around the side or back of neck occasionally has been set afire by high frequency sparks.

General Field of Usefulness to Cosmeticians. The high frequency currents are used in the form of direct or indirect spark or effleuve for the purpose of stimulating circulation in skin and scalp and thereby benefitting nutrition and metabolism; for destroying moles, etc.; for freeing the skin of excessive accumulations of waste or oily material; for the germicidal effect in acne, eczema, psoriasis and other eruptive

skin affections; for seborrhea, alopecia, falling hair, etc. Its action is usually more effective in these latter conditions when combined with infra-red, ultra-violet, etc. Chronic pathologies, like eczema or psoriasis, should not be treated by beauty culturists.

NOTES

CHAPTER TEN

Light

The use of light in various forms constitutes one of the most important and interesting branches of physical therapy. This embraces not only the use of the luminous rays of visible or so-called radiant, or therapeutic light, but also infra-red and ultra-violet. In fact, although it sounds paradoxical, the terms visible and invisible light are frequently used. The use of light in treatment is not new, but new forms and methods of production have arisen.

The value of sunlight to the human race calls for no comment. One scientist avers that if the sun's rays did not reach the earth for thirty

days, it would just be one big ball of ice swinging through space.

The light of the sun affords us both heat and chemical effects. It also contains a definite amount of the invisible, chemically active ultra-violet. This is lost when sun light passes through ordinary glass, but the chemical properties of light itself still remain. When a beam of white light is passed through a three-sided crystal known as a prism, it is separated into the various colors of the visible **spectrum**; that is the range of vibrations which our eyes perceive as light. Fig. 30.

The difference between the various colors, as well as ultra-violet, infra-red, etc., is in the wave length and the frequency of vibration.

The longest waves and the slowest frequency is found in the red, and the shortest waves in

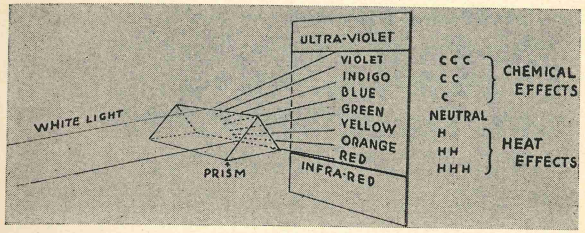


Fig. 30

the violet. In the illustration the various colors are shown and also the position of the infra-red and ultra-violet. It will be observed that the red, orange and yellow are the warm colors, producing a definite amount of heat, which is greatest in the red, less in the orange and still less in the yellow. There is no noticeable evidence of any chemical action in these colors, therefore we find the photographer using the red or orange light when handling photographic plates. They furnish sufficient illumination without containing the chemical factors which would fog or spoil the sensitive plate.

In the other half of the spectrum we have the cold or chemical colors, with definite chemical properties in the blue, more in the indigo, and most in the violet.

Green stands between the two divisions, containing no marked heat or chemical properties and therefore suitable as a neutral color. That is why it is Nature's universal color.

In Figure 31, I have reconstructed the spectrum, showing how infra-red adjoins one end and ultra-violet the other end of the visible spectrum. The lines below indicate the gradually shortening wave-lengths as we pass from infra-red through the spectrum and into the ultra-violet. The **longer** the **wave length the greater the penetration,** so we see that infra-red has **greater penetration** than visible light and the latter more than ultra-violet and long ultra-violet waves more than the short ultra-violet.

The diverging lines passing in either direction from the green indicate the gradually increasing chemical properties as we pass through to the ultra-violet and on the other side the increasing heat properties.

The prefix "infra" means "below," and so we have the invisible infra-red below the red of the visible spectrum. "Ultra" means "beyond" and the invisible ultra-violet lies beyond the violet

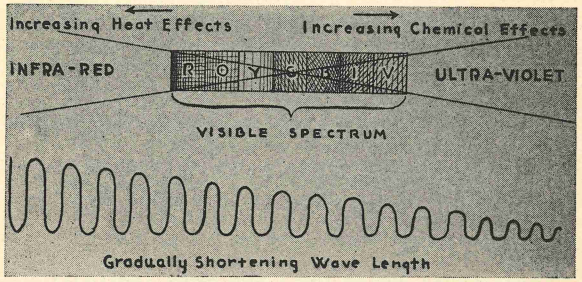


Fig. 31

of the spectrum. It is wholly chemical in its properties, just as the infra-red is outstanding for its marked and penetrating heat.

Visible light contains both heat and chemical properties. It has been used in beauty shops and by doctors principally for the effect of its radiant type of heat. Incandescent bulbs of various sizes and strengths have been used in small or large reflectors for the purpose of directing and reflecting the heat rays over face, scalp or body. It has been used for drying purposes; for its soothing effect over painful or inflamed areas, etc.

The chemical effects which are also available are not brought out except by a long treatment. The heat rays are longer and so are felt immediately, just as when one goes out into the summer sun, the long heat rays give instant evidence of their presence, but it requires some

time before the tanning or blistering effects of the chemical rays are produced.

As we know more about infra-red and ultra-violet, there is a growing tendency to use infra-red when heat is desired and the ultra-violet for chemical effects. Eventually there will be much less employment of the incandescent bulbs, because when heat is needed we have more in infra-red, and when chemical effects are sought we have purely and solely chemical rays in the ultra-violet.

Units of Measurement. There are certain units of measurement of light that it is necessary to become familiar with.

The first unit employed was the **micron,** the symbol for which is the Greek letter μ. It is one one-thousandth of a millimeter.

This soon proved to be too large a unit and so one was introduced that was only one one-

thousandth of a micron and this is called the **millimicron** and the symbol is the double $\mu\mu$.

Then **Angstrom** gave his name to a unit that was only one tenth of the size of a millimicron and the letter A is the abbreviation.

The name Angstrom is pronounced as though the A was like our long O, Ohngstrom.

A millimicron is one-millionth and an Angstrom one ten-millionth of a millimeter, and a millimeter is about the thickness of a dime, so it is pretty hard to form in one's mind any very adequate conception of these minute units of measurement.

NOTES

CHAPTER ELEVEN

Infra-Red

Source. Special burners or lamps are made for the production of infra-red. Ordinarily they are not luminous, but some forms as they become heated also give off some of the red and orange rays of visible light in addition to the infra-red. Some lamps produce long enough waves to have a penetration of several inches of body tissues.

The infra-red burners are placed usually at a distance of about thirty inches from the skin or scalp. At this distance, with a half hour or more of use there will be introduced deep into the tissues a wonderfully soothing and **beneficial type of heat** without danger of burning the

skin. This is a conversive form of heat, similar in effect to the conversive heat of diathermy. If too close, there is a possibility of a surface burn. When the skin becomes uncomfortably hot, just as with the radiant lights, the hand should be passed over the surface, removing the surface heat, or the burner may be moved farther away. In the relief of pain, long applications are advised. The sweat glands are actively stimulated, and thus elimination of poisons through the skin is greatly increased. The heat is of a type that is beneficial to vital processes. Doctors are making increased use of infra-red in treating various acute, painful conditions like neuralgia, lumbago, etc.

Beauticians find it useful in stimulating the activity of the glands, and freeing clogged pores and in producing increased blood-supply to a desired area of face or scalp.

The use of infra-red or the radiant light for

ten or twenty minutes prior to the administration of ultra-violet results in more of the latter being absorbed.

The infra-red is particularly satisfactory in conjunction with the use of oil, to aid, by its heat, the penetration of the oil.

In brittle hair, either that which is naturally so, or where it has become so from possibly too frequent or perhaps improper waving, after putting on the oil, place the lamp at the customary thirty inch distance and allow it to run half an hour.

Also where an oil is applied to assist in removing a dye, the same technique is followed.

I think, at times, there is a tendency to place the lamp too close to the patron because the heat is agreeable and felt more, but it is the effect of the penetration of the rays that is desired and that may be safely secured at the

thirty inch distance. If closer, surface burns will occasionally be produced. The method of securing a greater effect is not by placing burner closer, but by **lengthening the time** of the application.

Instead of the special infra-red lamps, which are my personal preference, many use the carbon arc lamps, **which give the whole range of infra-red, visible light and ultra-violet,** in short the whole range of the sun's rays. This and the whole subject of ultra-violet as produced by various forms of apparatus will be covered in Chapter Twelve.

The most effective infra-red rays are claimed to be those having a length in the neighborhood of 30,000 Angstrom units.

Patron's eyes should be protected from infra-red as well as from ultra-violet.

Types of Heat. There are three forms of heat as applied to the body. 1. **Conductive heat** as when one is in a hot bath, or has a hot water bag. The heat is conducted into the body. 2. **Convective heat** as with a high candle-power lamp or a reflector converging the heat on the body. 3. **Conversive heat** where the energy is converted into heat through the resistance offered by the tissues as in diathermy and infra-red.

NOTES

CHAPTER TWELVE

Ultra-Violet

Of all the physical measures employed today, there is none that has received greater publicity than ultra-violet. So much has appeared in the press concerning its remarkable action on foods and drugs, as well as its medical effect on rickets in children and many other physical ailments that present a deficiency in blood calcium.

If you will refer for a moment to Fig. 31, you will see that ultra-violet is at the opposite end of the visible spectrum from the infra-red, and, as its name "ultra" implies, it lies beyond the visible violet, and consists of shorter wave

lengths than those found in the visible spectrum. It starts in at about 3970 Angstrom units and essentially disappears at about 600 A. No therapeutic value has been found in those below 600. The most valuable waves are those down to about 1850 A. Those that are claimed to be most destructive to germs lie in the neighborhood of 2536 A.

Sources of Ultra-violet. Ultra-violet is present in the sun's rays and is also produced by the quartz mercury type burners, by carbon arc lamps and by the cold quartz lamps. Cosmeticians largely use the carbon arc lamps while medical men appear to more often employ the quartz burners.

A good carbon lamp is an efficient piece of apparatus. The ultra-violet is now obtained by the use of special standard carbons made for the purpose. They furnish satisfactory rays, although the quantity is less than from the stand-

ard quartz burners and a longer application is required.

I must caution operators against placing too much confidence in many of the small carbon lamps which do not have a sufficient volume of either ultra-violet or infra-red to accomplish the results expected of them.

Long and Short Rays, and Their General Action. Because the first ultra-violet lamps were of the quartz mercury type and these burners occurred in two forms, an air-cooled and a water-cooled type, we formed the habit of speaking of air-cooled and water-cooled ultra-violet, and the air-cooled was used for the longer rays and the water-cooled for the shorter or germicidal rays. As a matter of fact, both burners gave both the long and the short ultra-violet; but the air-cooled lamp is used at a distance of 30 to 36 inches, a point from which the shorter rays could not reach the skin, while the

water-cooled lamp is used close to the skin with a predominating effect thereby of the short rays.

Ultra-violet will not pass through ordinary glass but passes perfectly through quartz, so the mercury burners were made of fused quartz. There are several varieties, all good and effective.

The quartz transmits perfectly all rays down to 1849 Angstrom units, but not below that point.

As the current arcs or shorts through the burner, heat is formed. That is why in the water-cooled type a constant stream of cool water is kept circulating about the burner because the heat is unusually intense and would melt the burner.

Remember that the ultra-violet rays are in gradually shortening wave lengths as we go

from the violet end of the spectrum through the near ultra-violet and on to the very short waves of the far ultra-violet.

As the action of the long and the short waves is quite different, I have preferred to speak and think of ultra-violet in terms of long and short ultra-violet.

The general opinion has been that the longer waves are beneficial in character, building up the blood calcium, phosphorous and iron, and are life-giving in nature. They build up general bodily resistance to disease and are normalizing and reconstructive. On the other hand the short rays are destructive and germicidal in character, **unless used in very small doses.** They are remarkable in their bactericidal or germ-killing power, and it is claimed that no ordinary germ can live more than 28 seconds when directly exposed to short ultra-violet. However, they have very slight penetration because of the shortness of their wave lengths and

it therefore limits their direct field of germicidal action to surface conditions, such as ulcers, pustules, etc.

I believe, generally speaking, cosmeticians should not employ waves below about 2600 A.

For general surface applications, getting the benefit of the long rays, the customary working distance should not be less than 30 inches—30 to 36 inches makes a suitable distance and is far enough away to prevent the short, destructive rays from reaching the skin.

When the germicidal effects of the short rays are desired, the lamp should be within 12 inches of the skin; the closer to it the greater the intensity. Water-cooled lamps are ordinarily used with the quartz applicator in direct contact with the skin or at a distance of 2 to 4 inches. The cold quartz lamps also are used close to the skin.

Too long an application of ultra-violet will result in reddening and blistering of the skin exactly like an over-exposure to the sun. Mild exposures are followed usually in a few hours by some reddening of the skin, and not infrequently by some peeling of the skin even when not used to the point of blistering. Repeated doses result in tanning or pigmentation of the skin.

When a sufficient dose has been given to produce definite reddening (called erythema) another application is not made until this redness has faded. This means that ordinarily the applications are made about every other day.

More recently it has been shown that definite building up of blood calcium may be accomplished with doses so small that at no time is any definite redness noted.

Now the great value of the long ultra-violet is its power of building up bodily resistance,

and its direct action in increasing the blood calcium, as well as its phosphorous and iron.

In practically all skin and scalp diseases we have a deficiency in blood calcium, consequently there is a direct and logical reason for employing ultra-violet. I look upon calcium as one of our great defensive elements and I believe that if we had the normal amount of blood calcium these conditions of the skin and scalp could not develop.

In baldness, whether general or in the form of alopecia areata, ultra-violet has proved of definite value and is used in conjunction with high frequency sparks. A similar technique is useful in falling hair, where it is ordinarily combined with other local applications.

Infra-red or radiant light is often used to precede the ultra-violet and, by bringing on a local hyperemia (increased amount of blood), secure

a greater effect from the chemical ultra-violet which, at best, has only a slight penetration.

Where ultra-violet passes through the air its intensity decreases inversely as the square of the distance; that is, twice as far away, one-fourth as intense; three times as far away, one-ninth the strength, etc.

When ultra-violet is used without a direct skin contact, from quartz burners, no matter if used to the point of severe blistering, no scar will result, because the rays only penetrate the upper layers of the skin and do not affect the deep structure which causes a scar when injured.

Cases where scars have resulted have been from long contact with a water-cooled burner or from the carbon-arc close enough to permit of a **heat burn,** deep enough to cause the scarring.

Parts of the body not ordinarily exposed to light are found to be more sensitive. Brunettes

require relatively about 10% more exposure than blondes to produce the same results.

Testing Lamps and General Dosage. It is a good plan to test your lamp and find out about how long an exposure it takes to produce a good reddening, and then in practice start with half of that dose and increase every 3 doses. You can take a piece of cardboard and cut 3 small holes in it and put it on say the inner surface of the forearm. Cover two of the holes and let the ultra-violet shine on the one uncovered for from 30 seconds to 3 or 4 minutes, according to the type burner used, and in accordance with the claimed time required to cause redness. Then uncover another opening and continue for as long again and finally the same with the third hole uncovered. You will thus have three different applications in point of time and find out which one produces a good erythema; and, as stated before, then start or-

dinary cases with **one-half** this dose and **gradually increase.** With the tanning and pigmentation that takes place it is possible to gradually increase the length of the application without any untoward effects. If I could produce a definite reddening in a one minute application, I would never at any time, even after gradually building up the dose give over a 10 minute application. If it took 5 minutes to secure this result I would never go beyond 15 or 20 minutes. This with the long rays.

With the carbon arc lamp at 30 inches, and using the special carbons, 5 to 8 minutes will be the average dose used by cosmeticians, with half or less of that time if germicidal action is desired and burner is at about 12 inches. Carbon arc lamps should be protected by a screen and not placed where small particles of hot carbon may fall on patient.

Cautions. Do not fail to **protect both your own and the patron's eyes** by means of suit-

able goggles, such as are furnished for the purpose. Fig. 32.

I do not think the ultra-violet should be used by beauticians to secure blistering effects unless in conjunction with the physician.

Remember that it has been shown that overdoses of ultra-violet are possible and that some people have peculiar and unexplainable susceptibility (called idiosyncrasy).

Among physiotherapists the tendency is toward shorter ultra-violet and longer infra-red treatments.

Where a general toxic condition exists in an individual general ultra-violet should not be given such as in advanced tuberculosis of the lungs, etc., which is another reason why the beautician or scalp artist should work in conjunction with the physician.

Fig. 32

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CHAPTER THIRTEEN

Suggestions for the Use of Electrical Currents and Light in Skin and Scalp Conditions

By Way of Reminder. As stated in the Introduction the intention of the author has been to make this book a reliable treatise on the fundamental principles of electricity and light which would cover their general features; their derivation or mode of production; their action and general effect, etc., considered from the cosmetician's stand-point and thus suggesting their field of usefulness. Certain special techniques such as electrolysis and fulguration have been gone into definitely, but in general specific technique has been avoided believing it preferable that this should be taught by the teachers in the various schools.

What I have endeavored to do is to so outline the source and action of the electrical currents and light, that the proper ones to use for any condition will naturally suggest themselves. Too often, I think, we get in the habit of following a set technique just because we have seen someone else use it, or because it was the method originally taught us, without thinking whether it is right or wrong or without considering the possibility of improving it.

At the present time, rapid strides are being made to elevate the standards in beauty and scalp work, and more and newer electrical and light measures will be added to the older methods, and larger and better apparatus will be used—and used scientifically and intelligently, with better results.

It is always advisable to keep the general action of the various currents, etc., in mind, as that enables one to decide on or choose the one seemingly best suited to the case in hand.

Thus we remember that galvanism is the only chemical current and the only one with fixed polarity, giving us two opposite actions.

The faradic and sinusoidal are mechanical or exercise currents possessing in their true form no chemical action at all, but capable of exercising or massaging muscles and tissues to great advantage in building them up, unless overused, when a contrary effect may result.

The Tesla and other forms of high frequency currents afford germicidal sparks, increase local blood-supply and nourishment, stimulate glandular activity and produce a definite amount of heat.

From visible, radiant or therapeutic light we get both heat and chemical effects. From infrared we get a wonderful and penetrating type of heat with great nutritional value; very soothing in acute conditions and very valuable to

open pores; increase skin activity and to make it receptive to the absorption of oils, creams, etc. Also to bring blood to the surface that it may be reached better by the ultra-violet.

The ultra-violet itself is a chemical ray which with its **longer waves** builds up resistance to all infections, and is especially useful in restoring certain chemical elements, such as calcium, phosphorus and iron, to their normal proportion in the blood.

Furthermore, the **short rays** are germicidal and thus in nearly all skin and scalp conditions prove beneficial, as well as directly co-operating with the action of high frequency and other measures.

Now let us see how we may apply these principles. Suppose we have a skin which is inactive, with clogged pores, etc. Naturally heat will increase its activity, and thus we have

the heat of the radiant light or, better, that of infra-red to open the pores and get the glands in action. Then we recall that the negative pole of the galvanic current is dilating and promotes elimination, and thus it may be used in conjunction, as well as such skin aids as the cosmetician is familiar with.

After the cleansing and freeing process has been brought about, and it is desired to close the pores, then the positive galvanic pole is indicated. The same would be true of the latter for contracting too large pores from any cause.

If a germicidal action is required in a skin or scalp condition, then we have a choice of the high frequency spark, positive galvanism with germicidal solutions, and short ultra-violet.

One, two or all three may be used as seems advisable. You know perfectly well from your study and experience what is necessary in the

strictly cosmetic line for the several conditions, whether an astringent is required or a cleansing lotion or a hot oil or a tonic, etc.

Apply your currents and lights in the same way, because they will do certain things that you realize are necessary to success in a given case. You have currents and lights that relax and also those which tighten up; those which are germicidal and those that tone through exercise.

It is merely a question of keeping these various properties well in mind, or so that you know them as well as you know your creams and lotions and oils, and you will have no trouble selecting the right one and can rely on its definite and constant action.

Let us consider a few conditions with brief suggestions concerning the forms of electricity and light that are indicated. All reference to

the accompanying lotions and creams are purposely omitted.

Dandruff (Pityriasis simplex)—Infra-red in conjunction with negative galvanism and mild high frequency sparks. Manipulation with secondary faradic or sinusoidal indicated. Most individuals who have dandruff are deficient in their blood-calcium, and general applications of long ultra-violet are indicated.

Baldness (Alopecia) — In premature baldness, infra-red followed by short ultra-violet. Do not be afraid to blister, but be sure patron is willing. If not carried to this degree high frequency sparks, direct or indirect, aid by increasing local blood-supply. Similar method for Alopecia areata.

Blemishes (Moles, warts, etc.) — Where raised above the surface, destroy preferably by fulguration or desiccation or else by electrolysis with negative galvanism.

Falling hair—Increase nutrition of hair follicles by the action of the high frequency spark.

Infra-red ten minutes, followed by ultra-violet, usually advisable.

Superfluous hair — Destroy with negative galvanic electrolysis.

Pediculosis Capitis (Lice)—In conjunction with the local application of tincture of larkspur or spirits of camphor; the infra-red followed by high frequency sparks is desirable.

Acne Vulgaris (Pimples)—High frequency, direct or indirect. Infra-red to aid in bringing pustules to a head. Open those that are ready with sterile needle and then apply fine Tesla sparks for germicidal action. General ultra-violet to build up deficient blood calcium, phosphorus, and iron.

Canities (Grayness) — In premature grayness, where due apparently to defective nutrition or in nervous individuals, the process may be arrested frequently by the nutritional value

of high frequency sparks. Infra-red useful in conjunction, as well as manipulations with faradic or sinusoidal. Do not make patron any rash promises.

Eczema, psoriasis, etc., should be recognized by the cosmetician **but not treated,** unless under a physician's guidance. These are cases where the high frequency and ultra-violet are very useful and also where careful and moderate use of the X-ray may be desirable.

ELECTRICITY AND LIGHT

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GLOSSARY

Terms defined in accordance with their use in the text:

Active Electrode. Usually the smaller electrode, because patron's sensitiveness to it governs dosage. Where one electrode, as a brush, for example, is moving over the surface, it is also called the active electrode.

Alopecia. Baldness.

Alopecia areata. Baldness in spots.

Alternating Current. One that is constantly changing its direction, back and forth from positive to negative. Its frequency is below 10,000. When the frequency is 10,000 or more cycles it is then called an oscillating current (high frequency).

Alternation. One complete swing of current on either positive or negative side.

Ampere. The unit of current strength or intensity.

Amperage. The strength or dosage of current. In our work it is measured in milliamperes.

Anaphoresis. Driving a negative element into the tissues from the negative pole. Opposite of cataphoresis.

Anemia or **Anaemia.** A deficiency in the quality or quantity of the blood.

Angstrom. A unit of light-wave measurement. One ten-millionth of a millimeter.

Anode. The positive pole.

Antiseptic. Opposed to the development of sepsis or poisoning. A solution having this quality.

Astringent. Tending to contract or draw together organic tissues. Puckering or styptic like alum or like the positive pole.

Autocondensation. A method of using the high frequency current wherein the body takes the place of one layer of a condenser.

Bactericidal. Destroying bacteria.

Binding Posts. The terminals on the galvanic or faradic or other current to which the connecting cords are attached.

Bi-polar. Having two poles. In a bi-polar application patron is connected to both poles of the galvanic current.

Bi-terminal. Having two terminals. When the alternating or high frequency current is employed this term is used instead of bi-polar, since these currents have terminals but not poles.

Break. When the spring interrupter on the faradic coil opens or breaks the circuit in the primary coil. The opposite of "make".

Callus or **Callous.** A thickening of the skin as in a corn.

Cataphoresis. Driving a positive element into the skin by placing the solution containing it on the positive pole of the galvanic current. Opposite of anaphoresis.

Cathode. The negative pole.

Circuit. The entire course traversed by an electric current, either inside or outside of the apparatus. Patron's circuit is from one terminal or pole of a cur-

rent to the patron and then back to the other terminal.

Condenser. A part of the apparatus in which a charge of electricity is temporarily accumulated or stored up. The part carrying a positive charge is separated from that carrying a negative charge by means of an insulating substance called a di-electric. In the high frequency current the oscillating discharges of the condenser through the spark-gap raise the frequency of the current.

Conducting Cords. The cords which carry the current from the apparatus to the patron.

Conductive Heat. That conducted into the body through contact, as with a hot-water bag or a hot bath.

Conductor. A substance through which the current flows readily.

Coil. The turns of wire around either a core or a bobbin, such as the primary or secondary coil in the faradic or high frequency apparatus. Also used in a general sense, as the faradic coil, when the whole apparatus is meant.

Constant Current. One which maintains an even voltage.

Continuous Current. One which is steadily maintained, although some variation in voltage may occur.

Convective Heat. Radiant heat converging on the body through the action of a reflector, as in the high-wattage lamps.

Conversive Heat. Heat produced by conversion of electrical into heat units, as in diathermy and infra-red.

Converter. A transformer of current. Now ordinarily used in a restricted sense, meaning a rotary converter which mechanically interrupts the direct current to produce the alternating, or vice versa.

Cycle. In an alternating current, the complete round or circle of the current. One positive and one negative alternation.

Desiccation. A method of destroying small growths with a slight amount of high frequency heat which has the effect of drying or de-hydrating the tissues.

Diathermy. A method of using the high frequency current to produce increased heat in the tissues.

Direct Current. A current flowing in one direction as distinguished from the alternating type where the direction is constantly changing.

Dispersing Electrode. The larger or indifferent electrode.

Effleuve. The fine sparks coming from the glass vacuum electrode.

Electrode. The means of directly carrying the current into the patron's body. It may be a pad, a small sponge, a needle, the operator's hand, etc. It is attached to the farther end of the conducting cord and makes the direct contact with the patron's body.

Electrolyte. The solution or compound which is being decomposed by the action of the galvanic current.

Electrolysis. 1. Electrical analysis. The process of separating a solution or compound into its component elements through the polar action of the galvanic current. 2. Surgical electrolysis is the destruction of hair, moles, etc., through the electrolytic action of the galvanic current. Thus the removal of superfluous hair has come to be known as electrolysis.

Electron. A minute particle of electricity carrying a negative charge. Opposite of proton.

Elimination. Carrying off of waste products or of poisons through the natural channels of the body.

Follicle. The hair root. The depression from which the hair grows.

Frequency. The number of complete cycles occurring in one second of time.

Fulguration. Destruction of small growths with the concentrated heat of the high frequency current. Properly speaking, fulguration implies a greater heat than desiccation, going beyond the mere drying to an actual burning effect. Commonly obtained by the use of a needle electrode attached to the terminal of the secondary coil of the high frequency apparatus.

Germicidal. Destroying germs.

Hyperemia or Hyperaemia. An increased supply of blood in an area.

Hypersensitive. More than ordinarily sensitive.

Idiosyncrasy. Peculiar and unusual susceptibility or reaction to a drug or a current.

Indifferent Electrode. Opposite of active electrode. The dispersing or larger electrode.

Induction. The process of producing an electrical current or a charge of electricity in a coil or in a layer of condenser, without actual contact with the inducing current or charge.

Inhibit. To slow or stop the action of a function. To over-stimulate.

Inhibition. Tiring or slowing action resulting from over-stimulation.

Interrupter. A device for interrupting an electric current, like the vibrating spring on the faradic coil.

Inversely. In the opposite manner. Reversely.

Ion. A minute particle of electricity.

Ionization. Commonly used in the sense of cataphoresis or anaphoresis. The process of converting or separating a substance into ions.

Kilo. A Greek prefix meaning one thousand. When used in technical terms it means multiply by one thousand, as kilowatt, one thousand watts, kilogram, one thousand grams. It is used in the opposite manner to the Latin prefix milli which means divide by one thousand.

Luminous. Giving or emitting light.

Make and Break. The closing and opening of the circuit in the primary coil of the faradic current. The closing is called the "make". The opening the "break".

Metabolism. The process of converting food-products into living cells.

Meter. 1. An instrument for measuring an electric current. The galvanic meter is called a galvanometer. 2. The unit of the metric system of measurement. A meter is 39.37 inches, or a little more than a yard. A millimeter is one one-thousandth of a meter.

Micron. A unit of measurement for light waves. It is one one-thousandth of a millimeter.

Milli. A Latin prefix meaning a thousandth part of, as milliampere, one one-thousandth of an ampere; millimicron, one one-thousandth of a micron. Compare with kilo.

Milliampere. The unit for measuring medical electricity. One one-thousandth of an ampere.

Millimicron. A unit of light wave measurement. One one-thousandth of a micron or one one-millionth of a millimeter.

Modality. Any mode or method of using electricity or light, as galvanism, ultra-violet, etc.

Normal. Natural or usual.

Normalizing. Tending to restore a function or part to its natural action or condition.

Nutritional. The utilization of the processes resulting in the taking in and absorption of food substances.

Ohm. The unit of resistance to the passage of an electrical current.

Oscillating. A term used to distinguish the high frequency alternating type current from the lower frequency alternating currents.

Oscillation. Any of the series of intermittent discharges which make up the complete discharge of a condenser.

Papilla. A blood-vessel containing process of connective tissue extending into and nourishing the root of a hair. Commonly used also as meaning the hair follicle. The vessel-bearing part of the follicle.

Papilloma, plural, **Papillomata** or **Papillomas.** A small skin tumor or growth. Commonly employed in reference to the small, soft growths, but technically also includes corns and warts.

Pathological. Diseased. Condition present in disease as distinguished from that present in normal or physiological conditions.

Peak Voltage. The top voltage. The highest voltage reached in an alternation.

Pedicle. A stem.

Periodicity. In a uni-directional current where the voltage fluctuates up and down to produce a series of waves, the rapidity or frequency is called periodicity.

Phoresis. A general term embracing both cataphoresis and anaphoresis. The literal meaning of the term is "bearing".

Physics. That branch of science which deals with the material world. Natural philosophy. Now used in a restricted sense to cover the sciences of mechanics, heat, light, electricity and sound.

Physiological. The natural condition or action of the body and its functions, as distinguished from pathological or the condition when affected by disease.

Pigmentation. A deposit of pigment in the skin, such as follows exposure to the sun or to the ultra-violet. Tanning.

Polarity. Condition or state in respect to either of the galvanic poles.

Pole. Either of the terminals, positive or negative, of the galvanic current.

Positron. A positively charged particle or ion.

Potential. Electrical pressure. Measured in volts.

Pressure. Same as potential. Voltage.

Primary Coil. The first coil the current passes through, as distinguished from the second or secondary coil.

Proton. A positively charged ion or electrical particle.

Pulsating. Pulsatory. A unidirectional current may be made to move periodically up from its initial voltage and then drop back again, thus simulating a series of waves or pulsations. The pulsations are always on one side of the zero line, thus differing from alternations.

Reaction. The effect produced by an application of light or electricity.

Reconstructive. That action which tends to build up or restore a normal condition in the body.

Reflex. An involuntary contraction of a muscle resulting from nerve stimulation passing from the point to a nerve center and then back to the affected muscle.

Resistance. The opposition offered by the body or any substance to the passage of an electrical current. It is measured in ohms.

Rotary Converter. A motor driven machine for converting the direct into the alternating current, or the reverse thereof.

Secondary Coil. The coil in which the current is produced or induced following the current in the primary coil.

Sedative. Soothing or quieting.

Sine. In the angle formed by any two radii of a circle, a line drawn from the point where one radius touches the circle, perpendicular to the other radius, is known as the sine of the angle.

Spark-gap. A device for introducing resistance by means of an air space in a circuit. In the high frequency this results in building up a charge in the condenser until the voltage of this charge gives it the necessary power to jump across the spark-gap.

Spectrum. The colors found in white light when it is passed through a prism. They are in the order of their wave-length. This is the **visible spectrum.**

Stimulate. To irritate or excite increased activity in a nerve, muscle, organ or function.

Stimulation. Increased activity.

Terminal. That part of an electrical machine to which the cords are attached to carry the current to the patron. Used to distinguish those currents which do not have fixed polarity, like the sinusoidal and high frequency currents. The terminals of the galvanic current are called poles.

Tetanizing. Producing a constant contraction in a muscle without any relaxation.

Therapeutic. Pertaining to the healing art and means the application to the body for healing purposes of drugs, electricity, light, etc.

Tolerance. The amount of current which a patron can stand without its being too disagreeable.

Toxic. Poisonous. **Toxin.** A poisonous substance formed in the body as distinguished from an inorganic poison.

Transformer. 1. An apparatus for changing the voltage of a current. If the voltage is increased it is called a "step-up" transformer; if decreased, a "step-down" transformer. 2. A converter.

Unipolar. Using or having one pole.

Uniterminal. Using or having one terminal.

Varicose Veins. Enlarged or swollen veins.

Varicosed. Dilated or swollen, as varicosed veins.

Vaso-constrictor. A current or substance causing contraction in blood vessels. Opposite of vaso-dilator.

Vaso-dilator. Having the effect of causing blood-vessels to dilate. Opposite of vaso-constrictor.

Volt. The unit of electrical pressure or electro-motive-force.

Voltage. Electrical pressure or potential expressed in volts.

Watt. The unit of electrical power. One volt $\times$ one ampere $=$ 1 watt. 746 watts make one electrical horse-power.

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